



# Surgery, Gynecology and Obstetrics

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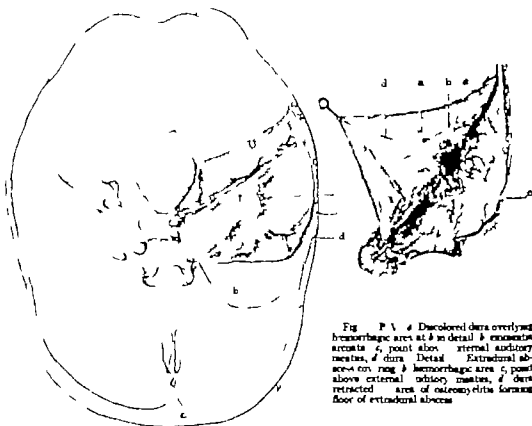


Fig. P. V. a Discolored dura overlying hemorrhagic area at b in detail b encephalic arachnoid c, point above external auditory meatus, d dura. Detail. Extradural abscess covering b hemorrhagic area c, point above external auditory meatus, d dura retracted area of osteomyelitis forming floor of extradural abscess.

# SURGERY, GYNECOLOGY AND OBSTETRICS

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## BRAIN ABSCESS WITH PATHOLOGICAL OBSERVATIONS<sup>1</sup>

By CHARLES BAGLEY, Jr. M.D. I.A.C.S. BALTIMORE

THE substance of these remarks is part of a study of twenty cases of brain abscess. Seventeen were operated on with a mortality of 47 per cent. Eight of the cases operated upon and three unoperated upon died and an autopsy was performed in eight of the eleven fatal cases. Points of interest are shown in the illustrations.

These illustrations have been selected for the purpose of showing (1) some of the avenues of infection, particularly those through which the infection reaches the brain of tympanic cavity inflammation, and of gunshot and traumatic injuries (2) behavior of the brain with regard to the formation of the abscess wall after the introduction of infection. Case reports are not attempted, but a few clinical facts are added that the pathological illustrations will not lack the value of a clinical background. Initials of patients are given that the material here may be connected with the full clinical history of the patient which it is planned to publish later.

### AVENUES OF INFECTION

The material illustrating avenues of infection has been arranged in four groups, some of which are subdivided.

Group I Presence of an extradural extension of the primary focus, with (a) protrusion of the distended dura into the cranial cavity, (b) direct extension from the extradural abscess (c) invasion from the extradural abscess along the blood vessels.

Group II Secondary invasion of the brain along the blood vessels without extradural link.

Group III Penetrating brain injury with infection by foreign body deep with or without stalk. (a) Path infected and open, hence long abscess stalk (b) path healed, hence no abscess stalk.

Group IV Abscess superficial and open secondary to direct laceration and infection of brain tissue.

### GROUP I—PRESENCE OF AN EXTRADURAL EXTENSION OF THE PRIMARY FOCUS

In considering the extension of infection from the tympanic cavity and accessory nasal sinuses to the brain the dura must be placed first in importance as a barrier. Osteomyelitis of the wall of any of the cavities adjacent to the dura is likely to result if thorough drainage of the pus is not accomplished within a reasonable time. Further extension of the inflammation is prevented when the process reaches the dura which because of its fibrous architecture is capable of active proliferation. Because of this defensive reaction the inflammation is limited to the extradural space for a period of sufficient length to justify its designation as one of the stages of extension of infection from the primary abscess to the brain.

It is important that this stage be recognized clinically because if the accumulation of pus is not evacuated early further extension will

<sup>1</sup> A presentation of lectures as he showed before the Southern Surgical Association, December 1922.

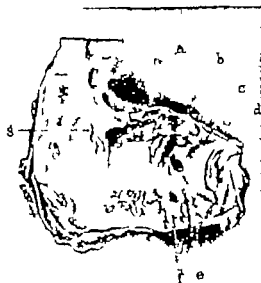


Fig. 1. A section through the temporal bone shown in Figure 1. Mastoid antrum as 1 of external suppurative, with osteomyelitis of its bony roof. b tympanic cavity also the seat of suppuration. c, hemorrhagic extravasation of carotid artery. branches of the popliteal artery. internal jugular vein. d dorsa of the cerebellum. e, f, close proximity to the suppurating antrum. g, h, squamous portion of the temporal bone.

almost certainly occur. In no specimen of our material has this extradural accumulation been large though several specimens demonstrate its occurrence. Extension from the extradural abscess in this series occurred in three different ways which have been arranged as subdivisions of Group I.



Fig. 4. L. F. Frontal view of brain with large abscess in right frontal lobe. a, Adherent dura of frontal lobe reflected toward midline. b, perforation of dura. c, perforation in frontal lobe, which is continuous with b and formed the abscess stalk.

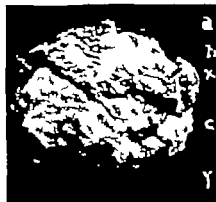


Fig. 3. R. L. Pedunculated dural abscess. Abscess stalk, point of attachment to dura. b layer of cerebral tissue adherent to abscess. c, fibrous tissue wall of abscess. site of section shown in Figure 3. y, site of section shown in Figure 6.

The abscess shown in Figure 1 (frontal view) a drawing of the temporal bone of P may be considered typical of this extradural stage in the extension of the infection.

P. V. 1917. Left otitis media in early childhood, cured but persistent discharge from left ear again 3 weeks before admission. Left temporal lobe abscess for approximately 3 weeks. Menstrual drainage of the abscess. Death.

This small extradural abscess was the result of necrosis of the roof of the tympanic cavity. The intracranial surface of the dura was not in contact with the inflammation and there were no adhesions between the dura and the cortex. A cross section of this temporal bone (Figure 4) showed external suppuration of the tympanic cavity and antrum with osteomyelitis of their bony covering.



Fig. 5. P. V. Frontal section of brain with left temporal lobe abscess. Abscess cavity. b abscess. all and site of section shown in Figure 3. c, site of section shown in Figure 3.

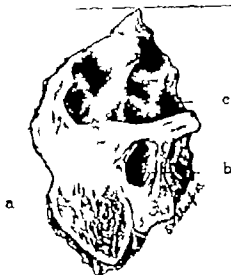


Fig 6 P V. A section through the temporal bone in Figure 6a, Mastoid process, no evidence of suppuration, b external auditory canal c squamous portion of temporal bone

The specimen shown in Figure 3 was the result of extension by protrusion of the distended dura into the cranial cavity.

R L age 37. Pedunculated dural abscess duration of approximately 4 months. Abscess removed without rupture. Recovery.

This abscess developed at the site of necrosis of the occipital bone. The cause of the necrosis was not determined. The formation of the abscess differed from the usual extradural abscess in which the dura is merely depressed into the skull cavity. In this instance only a limited part of the dura pro-



Fig 8 E M. a, Bone defect at site of subtemporal decompression b Metallic foreign body in left temporal bone c, probe passed through wound marking tract through which foreign body passed d floor of middle fossa of skull



Fig 7 R W. Upper surface of cerebellum, with abscess in left hemisphere underlying a. A cross-section of the abscess is shown in Figure 24. a, Point of spontaneous evacuation of abscess into posterior fossa

truded and was distended like a flask, owing to the slowness of the accumulation of pus.

Direct extension from the dural abscess is shown in Figure 4.

L F, age 20. Influenza 4 months before admission followed by right frontal sinus inflammation. Right frontal lobe abscess probable duration 2 months. Dr age of abscess. Death.

After necrosis of the posterior wall of the frontal sinus, a condition revealed at operation, there must have been an extradural abscess as shown in Figure 1. The center of the inflammatory area of the dura was broken down and there was a direct communication between the extradural abscess and the frontal lobe, evidently through a local adhesion between the dura and the frontal lobe preventing the spreading into general meningitis. The perforations shown at b and c formed the stalk of large frontal lobe abscess.

An abscess, the result of invasion from an extradural abscess along the blood vessels is shown in Figure 5 marking the further extension from the extradural abscess shown in



Fig 9 P L. a, Small skull defect, site of entrance of machine gun bullet seen (a)





Fig. 3 R. L. Section of wall of abscess shown in Figure 5. *a* cavity, *b* necrotic tissue covering inner surfaces of abscess wall. *c* all abscess wall shown also in Figure 14. *d* brain tissue, the site of astroglial proliferation.  $\times 5$



Fig. 4 R. L. Higher magnification of section from in Figure 3. *a*, Adult fibrous tissue strands, *b* young fibrous tissue elements.  $\times 325$

concluded that the cerebral symptoms were due to edema secondary to the extradural abscess rather than to an extension of the infection. A decompression was done—the value of which lay in the relief of intracranial pressure—while the inflammatory process was checked by drainage of the extradural abscess through the mastoid antrum with complete recovery.

External drainage of the area of bone necrosis, however, did not prevent the formation of the abscess shown in Figure 3. It is possible that the drainage diminished the amount of pus to be taken care of by the abscess wall to a point where the proliferation of fibrous tissue could keep pace with the distention.

It is probable that the inflammation extends directly from the extradural abscess more frequently than by the other methods described. The tract between the abscesses in some instances remains patent and offers a means of spontaneous evacuation of the brain abscess. In one case there was a history of chronic otitis media for 14 years, the drainage from the canal drying in amount. At times it was profuse, extending in a small stream from the canal and

over the side of the face for a period of several hours. For 3 weeks prior to admission there had been very little drainage but signs of serious increase of intracranial pressure terminated in respiratory collapse. While rhinocystic respiration was being carried on preparatory to draining the abscess, there was a free discharge of foul pus from the canal, so that further evacuation was not undertaken.

In spite of this spontaneous drainage, death resulted from the serious medullary disturbance. At autopsy there was found a sinus extending from the tympanic cavity to temporal lobe abscess.

#### GROUP II—SECONDARY INVASION OF THE BRAIN ALONG THE BLOOD VESSELS WITHOUT EXTRADURAL LINK

The superior petrosal sinus receiving the veins from both the tympanic cavity and the cortex of the temporal lobe constitutes an indirect vascular link through which infection may extend. The lateral sinus may likewise form a link between the mastoid cavity and



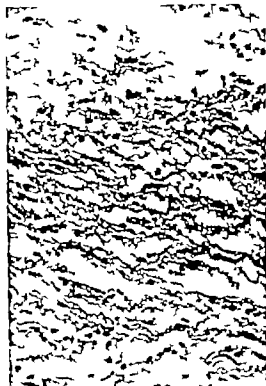


Fig. 5 R. L. A higher magnification of *d* in Figure 3, showing neuroglia fibrils  $\times 325$



Fig. 6 R. L. Section at *y* of wall of abscess shown in Figure 3. *a*, Abscess cavity. *b*, necrotic substance covering inner surface of wall. *c*, young fibrous tissue elements. *d*, adult fibrous tissue. *e*, cut of section shown in Figure 7  $\times 5$

the cerebellar hemisphere. The exact method of extension of infection along the blood vessels cannot be outlined except where there is a thrombosis of the sinus, in which case the infected content of the sinus may be dammed back into its tributaries, and thereby carry organisms into the poorly resistant cerebral tissue. It is probable that merely a condition of phlebitis with retardation of the blood current may cause this forcing back of infected material. The correctness of this explanation can be determined only by further observation the facts being that abscesses occur in the temporal lobe and cerebellar hemisphere secondary to tympanic cavity and mastoid inflammation without visible connecting tracts and that there exists the indirect anatomical connection stated above.

An illustration of an abscess formed in such manner is given in Figure 7

R. W. p. 5 *Left otitis media, mastoiditis and cerebellar hemisphere abscess. Probable duration of abscess 3 weeks. Streptococcus infection. Drainage. Death.*

There is no evidence of involvement of the meninges, though the left cerebellar hemisphere contained large abscess the infection evidently having reached the deep substance of the cerebellum along the blood vessels.

#### GROUP III.—PENETRATING BRAIN INJURY WITH INFECTION BY FOREIGN BODY DEEP WITH OR WITHOUT STALK

Penetrating wounds, complete or partial are prone to infection at any point along the tract. Experience in the front line hospitals proved the necessity of thorough cleansing of such wounds with a view to removing all devitalized tissue and foreign material, and when this was accomplished within a few hours after the injury primary closure of the wound was possible. When the penetration was incomplete foreign bodies were often lodged

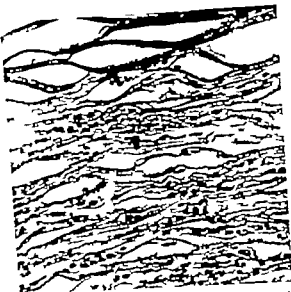


Fig 7 R. L. Higher magnification of section t in Figure 6 showing firm fibrous tissue strands X300

at such a depth in the brain substance that their removal was not possible at the front line hospital. In addition the stress of work at the front resulted in many cases being evacuated to the rear with incomplete operations. As a result of these conditions cases were returned to this country showing various types of cerebral lesions due to foreign bodies. In some the foreign bodies were encapsulated and the healing was complete. In others, a discharging sinus extended from the foreign body in the substance of the brain to the skull surface, serving to prevent the accumulation of pus at the site of the foreign body. In others, the tract remained open but the formation of pus was in excess of the amount discharged through the sinus so that an abscess resulted and in still others, the tract healed and an abscess formed in the neighborhood of the foreign body.

An abscess with a path infected and open forming a long abscess stalk is shown in Figure 8.

*F. M. age 25. Shell fragment entered temporal lobe through left malar region 1 gust 17 1918. Five months later symptoms of brain abscess. Left s b. temporal decompression. Abscess drained May 23, 1919. Recovery.*

The tract through which the metallic foreign body entered the temporal lobe is shown in the X ray photograph and is marked by the probe at This

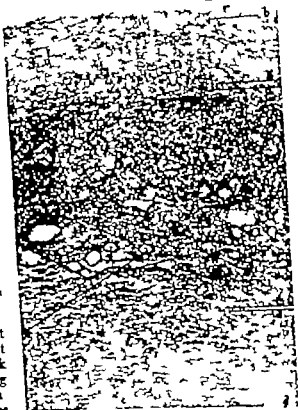


Fig 8 P. V. A section from in wall of abscess shows in Figure 5. Abscess cavity, b to d necrotic substance on inner surface of abscess wall, c to e abscess all d to e brain tissue, e, thin wall blood vessels, f framework of abscess all consisting chiefly of fibrous tissue proliferated from the blood vessels X85

tract remained open and continued to discharge pus from the abscess cavity from the time of the injury until the operation.

An abscess in which the path of the bullet healed leaving no abscess stalk, is shown in Figure 9.

*P. L. age 20. W. under September 27 1918. Dors age 7 abscess and removal of bullet, May 10 1919. Recovery.*

The abscess cavity is cut off from the wound of entrance by healing of the tract which extended through the occipital lobe and tentorium into the right cerebellar hemisphere.

The discharging sinus in the case of E. M. no doubt prevented the formation of the temporal lobe abscess for a number of months, and would have been more effective but for the effort made to have this tract heal, as its connection with the foreign body was not

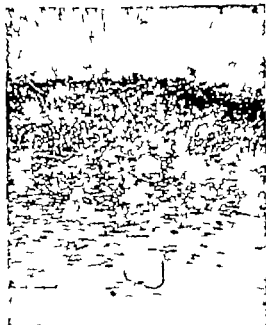


Fig. 9. P. V. V. section from the wall of abscess shown in Figure 8. a) to e) Inner layer of abscess wall. b) to d) hemorrhagic crusts within the abscess wall. e) outer portion of abscess wall showing extensive vascular proliferation and numerous punctate hemorrhages. X 5.

considered. The abscess was finally drained through part of the original tract. For after its communication with the abscess was discovered, an incision in the temporal region exposed the proximal end of the tract just below the floor of the middle fossa of the skull at which point very satisfactory drainage was obtained. The abscess was large with extensive destruction of cerebral tissue which resulted 3 years later in circulatory disturbance and impairment of function.

The other patient cited in this group was without symptoms of cerebellar disturbance. Removal of the foreign body was advised because of its size and the likelihood of cyst formation with destruction of cerebellar tissue. When the cerebellar cortex was opened there was a flow of pus which contained staphylococci.



Fig. 10. W. I. V. section from abscess wall shown in type I thaloma shown in Figure 8. Left of lower dura is a small band of adult fibrous tissue. X 15.

#### GROUP IV.—ABSCESS SUPERFICIAL AND OPEN SECONDARY TO DIRECT LACERATION AND INFECTION OF BRAIN TISSUE

Abscesses developing in neglected cases of compound fracture of the skull in which the surface opening is sufficiently large to permit a fairly free drainage of pus often tend to do well when the foreign material is removed and drainage established. In these cases the encephalitis which follows the injury is localized and circumscribed by the proliferation of the neighboring mesoblastic tissue. Here again the dura plays an important rôle. In some cases at least the ragged durai flaps, slipping into the disorganized cortex, proliferate and completely shut off the foreign material from the brain so that the resulting abscess is essentially extradural.

In the X-ray photograph in Figure 10 are seen shadows of the bone fragments extending in from the rim of the skull defect.



Fig. 1. L. F. A section from the w. of the abscess shown in Figure 4. Abscess cavity & disorganized tissue of inner layers all visible. Section seen in Figure 5. c, abscess wall & brain tissue adjacent to the abscess wall. X6.

W. J. J. age 25. Machine gun bullet wound October 5, 1918. Bullet only removed from frontal lobe. Hospital W. J. had healed constant drainage of pus. Operated. Removal of 6 mm wall abscess and 5 bone fragments May 31, 1919. Death.

Fibrous tissue surrounding the large bone fragments & formed the stalk of a thick walled abscess, in the center of which were contained the small fragments of bone. The abscess seen in Figure 1. The thick fibrous wall surrounding the fragments, as seen in Figure 1, must have been due to proliferation of fibrous tissue carried in with the bone fragments as the mass extended deep into the substance of the hemisphere entirely out of reach of any considerable amount of fibrous tissue. The character of the wall cannot be attributed to the long duration alone as other abscesses in the hemisphere the result of the same injury showed almost complete lack of fibrous tissue element.

#### BEHAVIOR OF THE BRAIN WITH REGARD TO THE FORMATION OF THE ABSCESS WALL AFTER THE INTRODUCTION OF INFECTION.

The term abscess indicates a circumscribed accumulation of pus and in this way the lesion under discussion suppurative encephalitis, differs from the diffuse type of cerebral inflammation which is not amenable to surgical treatment. Only the end results of the inflammatory process, namely the abscess wall, will be treated in this paper. (1) The wall of the abscess is the most important factor in determining the outcome of well managed brain abscesses. In all other inflammatory lesions the wall formation depends first upon the type of infecting organism, one of low virulence causing a more gradual accumulation of



Fig. 2. L. F. A higher magnification of w. of abscess seen in Figure 1, showing the membrane to consist of delicate fibrils. X35.



Fig. 3. L. F. Section of the innermost portion of abscess wall in Figure 2. Because of the necrosis the cellular elements have fallen out, leaving the delicate fibrils in plain view. X85.



Fig. 24 R. W. Cross section of cerebellum seen in Figure 7. Abscess cavity, *b* area of hemorrhagic exudation the result of thromboses, *c* site of section shown in Figure 5. *d* site of section seen in Figure 26.

pus than one of greater virulence thus allowing sufficient time for the protective reaction of the tissue (a) the resistance of the infected tissue is important, which protective reaction takes place principally in two kinds of tissue fibrous mesoblastic and glial epiblastic. The fibrous tissue is far more effective but, unfortunately is almost unavailable in the deep substance of the brain where glial tissue must suffice. In addition it is influenced by the method of infection as shown in the first part of this paper.

Abscesses of long duration may have walls of greater thickness, but it is more likely that the duration is long and the wall thick because of the character of tissue available for proliferation.

#### TYPES OF ABSCESS WALL

Type I Dense fibrous mesoblastic tissue wall

Type II Fairly firm wall containing some fibers proliferated from neighboring mesoblastic tissue

Type III Walls of varying thickness the result of glial proliferation

Type IV Walls showing no evidence of a protective reaction

#### Type I—Dense Fibrous Mesoblastic Tissue Wall

If fibrous tissue is available for the abscess wall it takes first place in the formation of the protective membrane. The meninges



Fig. 25 R. W. Section from 10 Figure 24. Note the large and small areas of thromboses. X85

constituted largely of fibrous tissue act as a barrier to pus (as in extradural abscess formation) and may furnish tissue for active proliferation and the walling off of infection even though the membranes be severely traumatized. Figures 11 and 12 for example, show the result of proliferation after a smashing skull injury. Figure 11 shows the firm wall abscess removed from W. F. M. in cross section. Figure 12 a photomicrograph shows the wall to be made of mesoblastic fibrous tissue.

A very unusual reaction of the dura appears in Figures 12 to 17 photomicrographs of a large abscess of 4 months duration which was confined entirely within the limits of the dural tissue. In Figure 13 the same abscess as shown in Figure 3 the firm fibrous tissue wall was the result of proliferation of the slowly distending dura. The next figure Figure 14 shows adult fibrous tissue strands and young fibrous tissue elements in this same abscess. Figure 16 shows the tensile quality of the fibers constituting the wall of the abscess, for a few strands were sufficient to protect the abscess against rupture. The quality of these strands is shown in Figure 17. Beyond the fibrous tissue wall there was neuroglial proliferation as shown in Figure 5. This latter

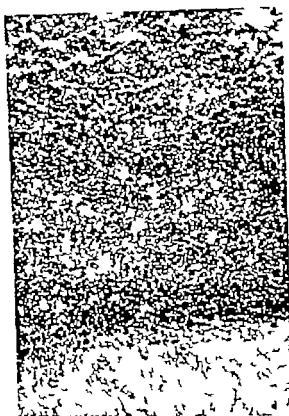


Fig. 16. R. W. Section from *d* in Figure 24. *b* to *b'* Nervous tissue beyond the area of necrosis. *c* to *c'* layer of granular cells of the cerebellum. *d* to *d'* molecular layer of the cerebellum.  $\times 85$ .

reaction of cerebral tissue of little importance in this case, is the main protective reaction in the wall of the abscess designated as Type III in this paper. The similarity between Figure 15 and Figure 22 is striking.

It is evident that the method of infection and the propinquity of mesoblastic tissue to the site of infection influence greatly the above-described formation of an abscess wall.

*Type II—Fairly Firm Wall Containing Some Fibers Proliferated from Neighboring Mesoblastic Tissues*

The type of abscess wall shown in Figure 18 while not the most valuable, represents the usual form of reaction when the infection occurs deeper than the fibrous tissue coverings. The chief reaction takes place in the glia but this is augmented by proliferation from the



Fig. 27. D. F. A transverse section through occipital pole of brain. Primary abscess with firm wall. *b* secondary abscess cavity. *c*, occipital pole of lateral ventricle.

mesoblastic elements of the blood vessels. In addition to the availability of the mesoblastic tissue, the quality of the resulting wall is likely to improve somewhat with the duration of the process. In our specimens all of which were of less than a year's duration the fibrous tissue proliferation reached a stage in no sense approximating the density of the wall shown under the heading of Type I. In Figure 20 the small band of fibrous tissue represented the most advanced stage of the fibrous tissue proliferation of an abscess wall which had existed as long as the wall shown in Figure 11. Hassan, however, described a wall of 8 years' duration in which the outer layer of the abscess wall was made up of adult fibrous tissue strands.

The question of time necessary for the proliferation of an abscess wall is an important one. It is certainly unusual for an abscess to exist for a period longer than a few months and walls of this type may be formed with great rapidity the history of the abscess



Fig. 28. P. V. Transverse section through the occipital pole of the brain shown in Figure 5. Occipital pole of the lateral ventricle converted into abscess cavity with necrotic wall, *b*, area of encephalitis; tract of evacuation of pus from the ventricle cavity to the subarachnoid space; thickened pia arachnoid *c*; rest of section shown in Figure 29.

shown in Figure 18 indicating that the wall was formed within a period of 3 or 4 weeks. The hemorrhages shown in Figure 19 were no doubt due to the very active vascular proliferation in the soft cerebral tissue.

### *Type III—Walls of Varying Thickness the Result of Glial Proliferation*

Walls formed almost entirely of glial fibrils may be very heavy, but because of the delicate character of the fibrils the wall is not so resistant as one in which there is fibrous tissue. In Figure 21 the wall was visible macroscopically and in this picture of low magnification has the appearance of a thick, hazy membrane, but the delicate quality of the tissue is shown in Figure 22. The relative value of this type wall and the firm fibrous tissue wall is perhaps best shown in Figure 13, in which there is a firm fibrous tissue wall at *c* and at *d* the adjacent cerebral tissue with glial proliferation. A photomicrograph of *d* given in Figure 5 is similar to the abscess wall shown microscopically in Figure 22.

The neuroglial fibrils are again well shown in Figure 23, which was taken from the innermost part of the abscess wall. A large part of the cellular element has fallen out because of the necrosis, leaving the fibrils in plain view.

### *Type IV—Walls Showing no Evidence of a Protective Reaction*

Figure 24 shows an abscess which was the result of a virulent streptococcus planted deep in the substance of the cerebellar hemisphere. There is no evidence of a protective reaction and the lesion marks an intermediate stage between an encephalitis and the usual abscess formation for though suppuration occurred there was no true barrier between the pus and the brain tissue. At *b* in Figure 24 there is an area of hemorrhagic extravasation, the result of thrombosis, which is also well shown in Figure 25, the destructive process entirely replacing the usual proliferative reaction. The merely necrotic end-result of the destructive process is shown in Figure 26.

Abscesses of this type also occur as secondary lesions to firm wall abscesses. In Figure 27 the primary abscess has a thick wall, the building of which, no doubt, required several weeks, but the extension from this abscess was doubtless more recent due to escape of pus into the substance of the occipital lobe an invasion altogether too sudden to allow the slowly proliferating glial tissue to form a protecting membrane.

D. F. p. 29. Gunshot wound left hemisphere July 4, 1918. Constant drainage of pus from the wound. Drainage of abscess June 22, 1919. Death June 30.

The architecture of the wall of the primary abscess is similar to that described under Group II. The firmness of the wall and heavy consistency of its content indicate a long duration. At *b* however, is larger abscess cavity with soft necrotic walls evidently due to a more recent extension from the original abscess.

Figure 28 shows an abscess also the result of extension from the firm wall abscess as seen in Figure 5. There was evidently leakage of pus into the occipital pole of the ventricle which was shut off anteriorly from the remaining part of the hemisphere ventricle so that the occipital pole was converted into an abscess cavity. Extending from the ventricle to the inferior surface of the brain, an inflammatory tract marks the site of the escape of pus into the subarachnoid space.

Figure 29 is a section from the ventricle wall of the specimen shown in Figure 28 illustrating the poor quality of the abscess wall which consists only of necrotic brain tissue entirely incapable of acting as a barrier to the pus content in the cavity.

The escape of pus from the abscess into the ventricle is a very common method of termination of neglected abscesses, but the conversion of a portion of the ventricle into an abscess cavity as shown in Figure 26 is certainly an uncommon reaction. The formation of secondary abscesses may be due to the ineffectiveness of an abscess wall as a barrier to constantly accumulating pus, or to organisms, so that such extension is dependent upon the duration of the abscess and the virulence of the organism producing it.

#### SUMMARY

The clinical course of a brain abscess varies according to the infecting organism the channel through which this organism reaches

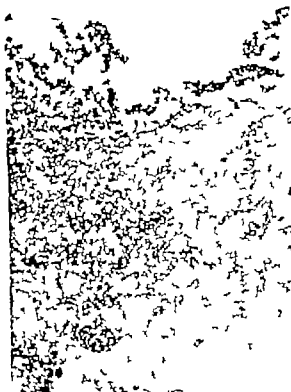


Fig. 29. P. V. Section of the abscess wall in Figure 28. *a*, Abscess cavity; *b* to *b'*, necrotic brain tissue surrounding pus; *c*, brain tissue beyond the necrotic zone.  $\times 85$ .

the brain, and the location of the infection in the brain substance as regards mesoblastic and epiblastic tissue.

This pathological study has been made as a basis for further consideration of the clinical data concerning these abscess cases.

NOTE.—This work has been done in the Neurological Laboratory of the Phipps Psychiatric Clinic, Johns Hopkins University and has been greatly facilitated by the interest and co-operation of Dr. Adolf Meyer. I am much indebted, also, to Miss Cecelia Benson for the histological and photographic preparation of the material.



## DIVERTICULUM OF THE URINARY BLADDER

B. E. STARR JUDD, M.D., I.A.C.S., ROCHESTER, MINNESOTA

Section on Surgery, Mayo Clinic

ALBERT J. SCHOLL, M.D., ROCHESTER, MINNESOTA

Resident Surgeon, St. Mary's Hospital

THE remarkable recent advances in diagnosis and surgical approach in cases of lesions of the kidney has been closely paralleled in the recognition and treatment of surgical diseases of the urinary bladder especially in cases of diverticulum. Until a few years ago diverticulum of the bladder was known only in the necropsy room or was occasionally discovered during exploration of the bladder for other lesions. Durré, in 1901 was able to collect only 194 cases from the literature; most of these were from necropsy protocols. In 1906 Young found in the literature 5 cases in which a diverticulum had been excised. He added to these cases 3 of his own. Six years later Lerche found 14 published cases of excision; he added one case to the list.

In the earlier cases treated surgically the condition was often discovered accidentally and the operation was carried out without consideration of the complicating lesion, and at times, of marked infection. The mortality was high and the operative results were only fair. Recent methods of urological diagnosis, however, make it possible to recognize the disease, the associated lesion, and the infection, and to suggest the type of surgical procedure which will give the most satisfactory results in a given case.

## ETIOLOGY

Vesical diverticula are probably due primarily to embryological defects in the bladder either a weakening of the musculature, usually at the base of the bladder or a definite hiatus in the wall of the bladder. Targett asserts that it is due to an interruption of the muscular fibers in the base of the bladder by the entrance of the large vesical artery in this region. The actual distention and dilatation of the sac probably result in most cases from obstruction to the outlet of the bladder.

Anschuetz says that most of the diverticula are of the pulsion type occurring in congenitally weakened parts of the bladder. Diverticula are often seen in young children and occasionally in the fetus. In a five months embryo seen at the Mayo Clinic, two definite diverticula were found in the region of each ureteral orifice. The one near the right orifice was composed of all the coats of the bladder and was 1 centimeter in depth (Fig. 1). Lennander reported a case in an infant of 21 months; the diverticulum apparently was caused by obstruction from a severe phimosis. Apparently some embryological malformation is essential to the development of diverticula. Not all cases of obstruction of the lower urinary tract in fetal life, or in early infancy cause sacculations. Marked phimosis, or other types of urinary obstruction are occasionally seen in the fetus or in early infancy causing distention of the bladder, hydro-ureter and fatal hydronephrosis, without evidence of vesical diverticula. Watson who observed the vesical cavity in the progressive development from early fetal life to birth, noted a congenital predisposition to diverticula. He says "Their clinical recognition during adult life is hastened and their dimensions greatly increased by increased vesical distention or increased activity of the bladder musculature. Kelly says "Diverticula of the bladder are usually formed from small pre-existing pouches or hernia in the bladder which become enlarged by pressure and later come into prominence through stagnation of urine and inflammation. According to Hinman, diverticula result from anatomical, pathological and mechanical factors, and in this sense the condition is acquired. He says "A mild chronic urinary obstruction in association with the necessary anatomical or pathological predisposing condition of the bladder wall is particularly conducive for the development of diverticula.

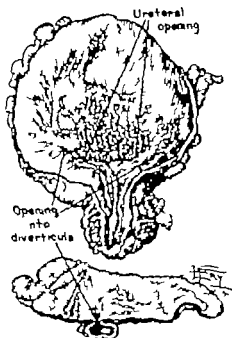


Fig. 1. Diverticula of the bladder in 3 months' embryo. The sac on the right side involved all the layers of the bladder wall.

The most common cause generally occurring in old men and causing distention and dilatation of the diverticular sac is obstruction of the neck of the bladder due, in most cases, to an enlarged prostate or to contraction of the neck of the bladder.

#### INCIDENCE

Large vesical diverticula sometimes do not cause trouble. They are found at necropsy in old men who have died of other diseases and who have had little or no bladder trouble during life. Apparently as long as the wall of the diverticulum is capable of contracting regularly and emptying its contents and is not infected it is a harmless condition. Obstruction of the bladder retention of urine infection and the not uncommon sequelae formation of stone or malignant degeneration make of this abnormality a venous, and sometimes a rapidly fatal disease. Harrison reported a case of a man aged 103 years who died suddenly from acute pericystitis which set in following infection of an apparently quiescent vesical diverticulum.

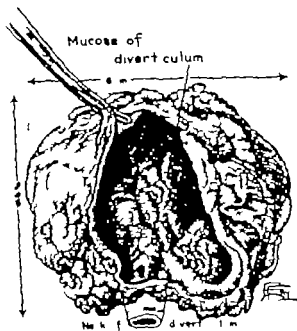


Fig. 2. Diverticulum of 200 cubic centimeter capacity with small outlet into the bladder.

The conditions predisposing to the recognition of vesical diverticulum obstruction, and infection are much more common in men than in women. True diverticula are exceedingly rare in women; they may be the result of anomalous formations of the bladder or cystic condition of the urachus, or they may be secondary to operative procedures affecting the bladder. In earlier case reports protrusions of the bladder through weakened perineal muscles were often grouped and reported as diverticula of the bladder.

Diverticula vary in capacity from about 1 cubic centimeter to several liters (Fig. 2). Braasch does not consider the small cellules, sometimes seen with trabeculation of the bladder as diverticula. Diverticula as large or larger than the normal bladder are not uncommon. Israel records the case of a man aged 66 years with a diverticulum three times the size of his bladder. Targett cites Green's case, which held a gallon of urine. Potbérat reported a sac holding 5.5 liters. The small diverticula are generally rounded or oval, and lie between the bladder and the rectum, extend-

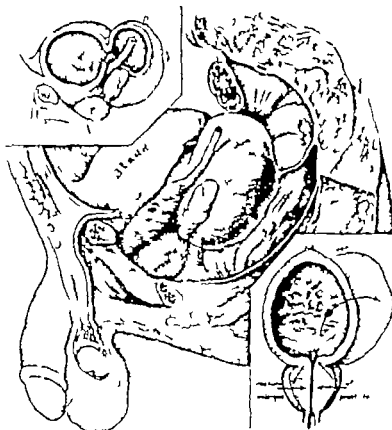


Fig. 3. Large diverticulum of the bladder extending upward between the rectum and bladder. Insets show location of outlet of sac bet. the bladder.

ing laterally and upward on increasing in size (Fig. 3). In young men before serious obstruction has set in the sac is often thick walled containing all the layers of the normal bladder. Long standing, mild obstruction and infection cause distention and dilatation of the sac, the wall becomes stretched and thinned, and muscular tissue atrophies or disappears. The bladder itself is generally hypertrophied and thick walled. Rehlfisch believes that this hypertrophy of the wall of the bladder results from continued action of the vesical musculature; the bladder is always manipulating urine; it is never completely relaxed. After it is partially emptied the pressure falls, and the urine runs from the diverticulum to the bladder increasing the work of delivery.

#### REVIEW OF CASES

From the year 1894 to 1923 133 cases of diverticulum of the bladder have been treated surgically at the Mayo Clinic. One hundred thirty-one of the patients were men and two were women. Complete postoperative data were obtained on 110 (83.9 per cent) cases. Ninety of the patients (67.6 per cent of 133) had single diverticula; forty-three (32.3 per cent of 133) had multiple diverticula; seven had two, ten had three, six had four and in ten the number was not determined.

#### AGE OF PATIENTS

Diverticula may be found during any period of life but they are most common in old men of prostatic age (Table 1). Cases in which this condition has been found in the fetus are

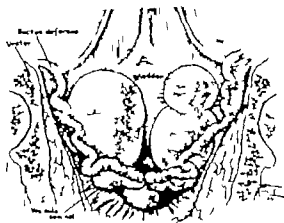


Fig. 4. Posterior view of large bilateral diverticula.

reported by Durrieux Fischer and others. In most cases in which symptoms are present before puberty they appear shortly after birth. Clark reported the case of a child aged 5½ years with a vesical diverticulum who had had urinary difficulty for 4 years. Rorig reported a similar case in a child, aged 2½ years, with urinary symptoms since birth. Englisch noted the case of an infant of 8 days, with a vesical diverticulum containing a stone. Frons reported a case of a girl aged 12 years, with symptoms of appendicitis. A large cystic right abdominal tumor was found and on exploration a vesical diverticulum was removed. Hyman reported three cases of excision of diverticula in young children. One patient was only 9 months old; two large diverticula were resected with a good ultimate result. On one side the ureter was involved in the diverticulum.

#### LOCATION

The orifices of either the single or multiple diverticula are usually in the region of the ureteral orifices. Of 163 cases collected by Hinman in which the location of the outlet was noted 123 (75.4 per cent) were near the ureteral orifices. The opening is sometimes found on the lateral wall or in the fundus. It is only rarely that the trigone is involved though occasionally an opening is found just above the interureteric ridge. Liston reported a case of a large diverticulum, the mouth of which involved the whole extent of the tri-

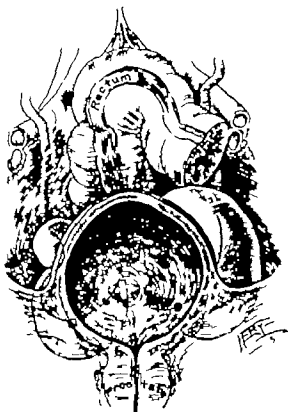


Fig. 5. Anterior view of diverticula, showing location of bilateral outlet into the urinary bladder. Bilocular diverticula on right communicating by means of a small orifice.

gone. The unusual position of the outlet was explained by the fact that the cause of the urinary obstruction was in action at the end of fetal life, and therefore, its greatest effect was produced on the trigone, or the portion of the bladder which is the last to be developed.

Diverticula which open in the dome are generally small and often multiple. True single large diverticula occurring in the dome,

TABLE I.—INCIDENCE OF OCCURRENCE OF DIVERTICULA BY DECADES

Years	Patients
1 to 30	4
31 to 40	9
41 to 50	14
51 to 60	44
61 to 70	48
71 to 80	3
Total	133
66 per cent between 30 and 70	

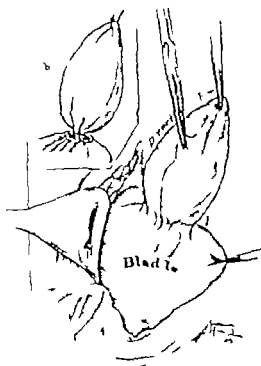


Fig. 6. Dissection of diverticulum from surrounding tissue with ligation of the neck of the sac.

are rare and are sometimes confused with cystic conditions of the urachus. The single diverticula were located in the right wall ureteral area in 33 cases. In the right wall high lateral area in 3. In the left wall ureteral area in 32. In the base between the ureteric orifices and above the interureteric ridges in 14. And in the fundus and dome in 8.

The location in 23 of the 43 cases of multiple diverticula is known. In 15 instances one outlet was located in the ureteral area. In 5 the openings were in the base of the bladder. In 3 on the lateral wall and in 1 the multiple orifices were in the dome (Figs. 4 and 5).

#### OPERATIVE PROCEDURES (133 CASES)

**Excision of diverticula.** In 50 cases (37.39 per cent) excision alone was done. 3 patients died, giving an operative mortality of 6 per cent (Table II). The diverticula were mostly large and no other lesion was present. In 37 cases the diverticula were single, and in 13

TABLE II.—LOCATION OF DIVERTICULA IN FIFTY CASES IN WHICH EXCISION ALONE WAS DONE

Case	
16	Single diverticula
1	Right wall, ureteral area
1	Right wall, high lateral
3	Left wall, ureteral area
5	Base
8	Fundus
37	Total
4	Multiple diverticula
4	Two diverticula, one in each ureteral area
1	Two diverticula, one in right, all others in left
3	Four diverticula, one in left, 7 and three in left ureteral area
3	Two diverticula, right ureteral area
3	Two diverticula, left ureteral area
3	Four diverticula, in dome
37	Total

TABLE III.—POSTOPERATIVE DATA IN THIRTY-SIX OF THE FORTY-FIVE CASES IN WHICH THE DIVERTICULUM WAS REMOVED EXTRA-VEGETALLY

Patients living	(7.5 per cent of 37)	16
3 yrs after operation	6	Complete cure on retention test
3 yrs after operation	4	
2 yrs after operation	4	
4 yrs after operation	4	
5 yrs after operation	4	
6 yrs after operation	4	
7 yrs after operation	4	
Total	37	
Patients dead	(7.5 percent of 37)	
1st month after operation	3	
Second month after operation	4	
(Three of these died of carcinoma of the bladder)		
First second year after operation	3	
(Two of these died of carcinoma of the bladder)		
Deceased before operation		

TABLE IV.—POSTOPERATIVE DATA ON THIRTY CASES IN WHICH THE DIVERTICULUM WAS REMOVED TRANSVASCULARLY

Case	
16	3 yrs after operation without symptoms
16	3 yrs after operation without symptoms
16	3 yrs after operation without symptoms

multiple. In 47 cases the diverticula were excised extravesically (Table III). The bladder was opened suprapubically, one or two fingers were placed in the orifice of the diverticulum and used to exert traction on the sac which was then dissected out. The sac was

TABLE V—POSTOPERATIVE DATA ON TWENTY THREE OF THE THIRTY-ONE CASES IN WHICH PROSTATECTOMY AND EXTRAVESICAL REMOVAL OF THE DIVERTICULA WERE DONE

Patients living	(65 per cent of 31)	Complete recovery	Bladder trouble
Year after operation			
3 years after operation			
4 years after operation		3	
5 years after operation		3	
6 years after operation			
9 years after operation			
Total		1	3
Patients dead	(54.9 per cent of 23)		8
First month after operation			3
Second to twelfth month after operation			3
T years after operation			
Three years after operation (carcinoma of bladder)			

TABLE VI—POSTOPERATIVE DATA ON THREE OF SIX CASES IN WHICH PROSTATECTOMY AND TRANSVESICAL REMOVAL OF THE DIVERTICULUM WERE DONE

Alive	Year after operation	Cases
Alive	Years after operation (has severe cystitis)	

TABLE VII—LOCATION OF DIVERTICULA IN THIRTY SEVEN CASES IN WHICH EXCISION AND PROSTATECTOMY WERE PERFORMED

Single diverticula	Cases
Right, all, ureteral area	
Left wall, ureteral area	7
Right, all, high lateral	
Base	4
Fundus	3
Total	27
Multiple diverticula	
T diverticula in one ureteral area	3
T diverticula one in each ureteral area	
Two or more diverticula in base	5
Total	

cut off at the neck and the bladder closed with two rows of suture (Figs 6 and 7). In 3 cases the diverticula were removed transvesically by the method described by Young in 1906 (Table IV). This method is applicable only to the smaller diverticula, and to those not markedly adherent to the surrounding structures. A pair of forceps was passed through the orifice of the diverticulum, and the base of the sac was grasped and drawn upward and inverted into the bladder. The sac was then cut off at the neck, and the orifice closed (Fig 8).

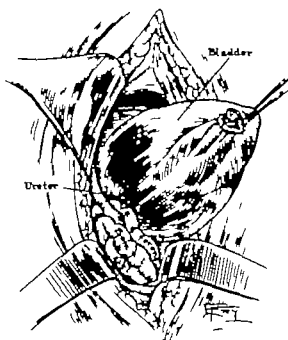


Fig 7 Loose atomic bladder raised from the incision, exposing structures surrounding diverticulum after its removal

#### Excision of diverticulum and prostatectomy

In 37 cases (27.81 per cent) excision of the diverticulum and prostatectomy were done. 3 patients died, giving an operative mortality of 8.1 per cent. In 31 of these cases the diverticulum was excised extravesically. In 6 it was removed transvesically (Tables V, VI, and VII).

**Palliative operation.** In 44 cases (34.58 per cent) the diverticulum was not removed. Prostatectomy and dilatation of the outlet of the diverticulum were done in 23 cases. In 11 cases, the outlet was dilated, and stones removed. In 10 cases, the bladder was drained and the outlet of the diverticulum dilated (Tables VIII, IX, and X). There was one case in which the diverticulum was obliterated transperitoneally and one case in which the lining of the diverticular sac was curetted, both with good immediate post-operative results. No later data were obtainable.

#### DISCUSSION

No single definite method of treatment can be followed in all cases. If there is definite obstruction at the neck of the bladder this

TABLE VIII — POSTOPERATIVE DATA ON TWENTY TWO OF TWENTY THREE CASES IN WHICH PROSTATECTOMY AND DILATATION OF THE OUTLET OF THE DIVERTICULUM WERE DONE

Patients living	(63 per cent of 22)	Cases
No further symptoms to 6 years after operation		5
No further symptoms 1 year after operation		6
Persistence of bladder trouble 10 years after operation		7
Patients dead	(3 1/2 per cent of 22)	7
First month after operation		4
were associated with enormous diverticulum		
had multiple diverticula		
had carcinoma of the prostate		
(One year after operation)		
Two years after operation (carcinoma of bladder)		
Five years after operation		

TABLE IX — POSTOPERATIVE DATA ON FIVE OF THE ELEVEN CASES IN WHICH THE OUTLET WAS DILATED AND STONES REMOVED

Patients living	Cases
No symptoms of bladder trouble 3 years after operation	4
No symptoms of bladder trouble 1 year after operation	
Symptoms of diverticulum persisting one year after operation	
Died 1 year after operation	

TABLE X — POSTOPERATIVE DATA ON EIGHT OF THE TEN CASES IN WHICH THE BLADDER WAS DILATED AND THE OUTLET OF THE DIVERTICULUM DILATED

Patients living	Cases
No symptoms of bladder trouble for 4 years	4
Drainage from suprapubic opening for 3 years	
Drainage from suprapubic opening for 1 year	
Patients dead	4
Died first month after operation	3
of carcinoma of the bladder	
of carcinoma of the prostate	
apparently from spinal anesthesia	
Died 1 year after operation	

and the diverticula must be attended to before the bladder will function normally. Case 1 illustrates the various methods of excision that may be adapted to suit the case.

CASE 1 (A 1663.) A man, age 29, came to the clinic on account of frequency of micturition. At operation three diverticula were found, a large one opening the left ureteral area was excised extravesically. Small sac of about 30 cubic centimeters capacity lying below the left ureter was inverted into the bladder and removed intravesically.

and small diverticulum of several cubic centimeters was merely stitched over. The patient made a good operative recovery.

In cases of diverticula in young men, and in patients without urinary infection good results are generally obtained after removal. The diverticula are only rarely attached to surrounding structures and generally dissect out easily. In this series were 11 cases without urinary infection. One patient died of bilateral hydronephrosis 8 days after operation. Complete postoperative data were obtained concerning 8 of the remaining 10. One died 2 years after operation. The remaining 7 are living and well from 1 to 10 years after operation.

*Drainage of diverticula.* In certain cases especially large infected diverticula excision exposes a wide area to infection. Drainage of the bladder and diverticulum as carried out by Hunt will reduce the infection and cause the diverticulum to shrink markedly permitting a safer secondary resection later.

CASE 2 (A 370005.) A diverticulum, the size of normal bladder was found opening near the left ureteral orifice. There was marked infection and the wall of the bladder was thick and hypertrophied. The bladder was drained. One month later cystogram injected through the suprapubic sinus revealed that the diverticulum had shrunk to about 4 centimeters in diameter. Two months after the first operation the infection had decreased, and the diverticulum, which was comparatively small, was readily dissected out and excised extravesically.

CASE 3 (A 850367.) A diverticulum, of 50 cubic centimeters capacity was found opening in the posterior wall of the bladder. The patient was not in condition for an extensive operation, therefore the bladder was drained only. Two months later the sac had shrunk to about 30 cubic centimeters and was excised intra-cavally. Prostatectomy was also performed. There was very little bleeding at this operation. One year later the patient was living and well.

*Involvement of the ureter.* Not infrequently the ureter opens directly into the diverticulum or it may be incorporated in the wall of the sac, or matted in adhesions, so that it must be cut in order to remove the diverticulum. Himman, in 12 of 405 collected cases found the ureter involved. Marion described a specimen from the Musée Civale in which both ureteral orifices were contained in a diverticulum. As brought out in an earlier

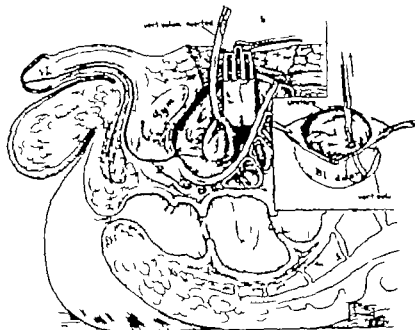


Fig 2. Transvesical removal of diverticulum. Insert shows method of grasping inner wall of diverticulum preparatory to inverting it into the bladder.

paper (20) in cases in which the ureteral opening is found to be marginal, the adjoining mucous membrane should be turned into the closure of the bladder. Hydro-ureter and destruction of the kidney are often produced by pressure from the diverticulum on the lower ureter at times causing almost complete obstruction. Paschke reported a case of this type. The diverticulum in such cases is generally small, sometimes bilateral and its neck crosses the ureter at the uretero-vesical angle. In removing a diverticulum in which the ureter is involved the condition of the ureter should determine the advisability of transplanting it to a different part of the bladder. In an occasional case, especially in young men in whom there is only moderate infection, it is advisable to attempt to conserve the involved kidney and transplant the ureter to a different portion of the bladder.

**CASE 4 (A313976)** A man, age 32 had complained of bladder discomfort for 2 years. At operation diverticulum, almost as large as the bladder was found. The left ureter which opened directly into the sac, was normal in appearance. It was transplanted into the bladder. A small catheter was then inserted into the reimplanted ureter and the diver-

ticulum excised. Six years later the patient was living and well, although occasionally there was evidence of urinary infection.

In four cases in which the ureter opened directly into the bladder it was merely ligated cut, and allowed to drop back into the wound. This is a satisfactory procedure if the opposite kidney functions normally and if the ligated side is not markedly infected. In two cases there was no further difficulty the third (Case 5) illustrates the need for determining the functional capacity of the opposite kidney and the fourth (Case 6) the result of ligation when the corresponding kidney is infected.

**CASE 5 (A313370)** A man, age 60, had had complete retention for 2 months, requiring constant catheterization. At operation the bladder was large, thick-walled, and badly infected. A diverticulum holding from 800 to 1000 cubic centimeters opened in the left base and involved the ureteral orifice. This was excised extra-capsulically and the ureter ligated. The patient did not recover well from the operation, urination was scanty and he died of sepsis on the fifteenth day.

**CASE 6 (A320633)** A man, age 66 had had difficulty in, and frequency of micturition and pain in the bladder for 4 years. He had 1500 cubic



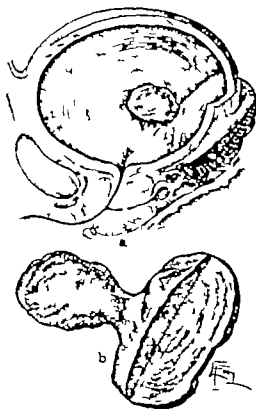


Fig. 9. Dumb-bell type of stone with the larger portion in the diverticulum.

centimeters of residual urine. A diverticulum three times the size of a normal bladder was found at operation. This was drained and months later abscessed extra-capsulally. The right ureter which opened into the diverticulum, was large, dilated and infected, it was ligated and cut. The patient passed a little urine following the operation; temperature and pulse became markedly elevated and there was absence of right renal action. After drainage of the right renal pelvis, symptoms subsided, and patient urine passed to bring him through the critical period.

**Stone and diverticulum.** Apparently urinary obstruction and the sacculation of infected urine are conducive to the formation of calculi. Cassanetto reported a case of a man aged 72 years, with a stone 10 centimeters in diameter impacted in a diverticulum at the base of the bladder. Fenwick reported a case in which there was a large hour glass stone the larger half of which was in the divertic-

ulum. In order to remove the portion in the diverticulum, it was necessary to fracture it with a mallet and chisel. Kummer reported a case in which the stone in the diverticulum weighed 350 grams. Generally when large stones are found in the diverticulum there are also stones in the bladder. Englisch was able to collect from the literature 171 cases of stone in a diverticulum; twenty-one of the patients were under 10 years. Seventy-nine had a single stone. Operation was performed on 124 patients, with 44 deaths. In most cases the operation consisted of merely removing the stone. In 13 children under 10 years, with vesical diverticulum, Durieux found 8 to have stones in the diverticulum. Dumb-bell and hour-glass shapes are not uncommon types; generally the larger portion of the stone is in the diverticulum (Fig. 9). Cases of this type are reported by Cassanetto, Fenwick, Kelly, Martin, and Crenshaw and Crompton.

In a review of the cases of vesical calculi and diverticula treated at the Mayo Clinic, both with cutting and endovesical procedures, Crenshaw and Crompton found 28 (12.1 per cent of 609 cases of vesical calculi) in which these two conditions were associated. There were 13 cases in which the stone was in the bladder alone, 9 with stone in the bladder and diverticula, and 6 with stone in the diverticulum alone. The statistics of Crenshaw and Crompton indicate that stagnation and infection of urine are factors in the formation of these stones. In the 28 cases of stones and diverticula, 3 patients had passed many stones before coming to the Clinic, 6 had had stones removed at previous operation, one having had two operations. In the cases in which the diverticulum was not removed at the first operation in the Clinic, there were seven recurrences of stone in 4 patients, 5 in the bladder and 2 in the diverticulum. The total number of recurrent stones was 17 in 13 patients. In cases in which the diverticulum was removed there were no recurrences of stone.

In 20 cases of the series of 133 cases, diverticula were associated with calculi. Stone was found in the diverticulum in 9 cases. In 6 of these it was removed and the diverticulum

excised. There were no deaths. Recent reports from 5 patients show that 3 are alive with symptoms of bladder trouble 2 years after operation, one patient complains of cystitis 2 years after operation and one is alive 5 years after operation without symptoms. In 3 cases the stone was removed, and the bladder drained the diverticulum was not removed. In one case in which a recurrent stone was removed the patient is alive 5 years after operation without symptoms. One died 1 month after operation of pulmonary embolism one was not heard from. In 8 cases of stone in the bladder only one patient, with excision of diverticulum and removal of stones, is well 1 year after operation. One patient with removal of stones only is well 5 years after operation. One patient, 1 year after removal of stones only still has cystitis, and one patient 6 years after removal of stones only has cystitis. One patient with removal of stones, excision of diverticulum and excision of epithelioma of the bladder died 3 years after operation. One patient, with removal of stones only died 2 weeks after operation. Two patients have not been heard from. In three cases with stone in the bladder and diverticulum one patient with removal of stones and excision of diverticulum died 1 year after operation. One patient, with removal of stones died of epithelioma of the bladder 1 year after operation and one patient was not heard from.

**Carcinoma and diverticulum.** Malignant tumors are not uncommonly found in association with diverticulum. The infection and inflammation and the occasional irritation from calculi are apparently conducive to the formation of new growths as the incidence of association of diverticulum and carcinoma is very high. Targett described three cases from London museums in one the diverticulum contained a large sarcoma, one a papillomatous tumor and one an epithelioma which grew into the diverticulum from the wall of the bladder. Young reported a case in which a carcinoma was found protruding from a pen point diverticular orifice. The diverticulum and growth were resected with a good result. Other cases in which a diverticulum contained a malignant tumor are reported by



Fig. 1. Diverticulum containing a small malignoma.

Buerger, Perthes and Englisch. Hofmohr reports a case of a very large single diverticulum which was filled with polyp. In our series of 133 cases carcinoma was found in 10.

#### CARCINOMA OCCURRING IN THE DIVERTICULUM —FOUR CASES

**CASE 7 (A15377).** A man, age 62, had had hematuria and dysuria for 2 years. At cystoscopic examination a diverticulum was found. The orifice was 1 centimeter above the right ureteral outlet, and a small papillomatous mass was seen protruding from the diverticulum. At operation the diverticulum was excised extravesically and the patient convalesced uneventfully. Five months later he returned with an inoperable tumor in the suprapubic area. He died 1 year after operation (Fig. 10).

**CASE 8 (A314566).** A man, age 62, had complained for 3 years of difficulty in urination and periods of attacks of hematuria. Cystoscopic examination revealed an epithelioma, 4 centimeters in diameter surrounding and growing into a diverticular orifice in the left ureteral area. At operation one fourth of the bladder was removed together with the diverticulum and lower left ureter. A partial prostatectomy was performed and the ureter reimplanted into the bladder. The diverticulum had a capacity of about 50 cubic centimeters. The patient died 6 months later, probably from a recurrence.

**CASE 9 (A273376).** A man, age 65, had had hematuria for 3 years. Cystoscopic examination revealed a diverticulum of the left upper wall with an epithelioma protruding through the orifice. At operation a diverticulum of about 100 cubic centimeters capacity was found. At the margin of the growth and extending into the neck of the diverticulum was an indurated, flat, malignant growth. The entire surrounding mucosa and diverticulum were removed in one piece. The patient improved following the operation, but shortly afterward, again complained of difficulty in micturition. He died 3 years after operation (Fig. 11).

**CASE 10 (A34564).** A man, age 57, came to the clinic on account of intermittent hematuria of 10

months duration. Cystoscopic examination revealed a diverticulum of the right wall and base with papillomatous tumor protruding from the orifice. At operation the growth was found to be very extensive and fixed, and it involved the overlying peritoneum. The glands along the right internal iliac artery were involved. Four 15 milligram radium needles were inserted into the growth extravesically, remaining in place for 48 hours. The patient died on the twenty-fifth day after operation.

#### DIVERTICULUM AND CARCINOMA OF THE BLADDER—SIX CASES

CASE 1 (A68773) A man, age 63, complained of nocturia and frequency of 5 years duration. Recently he had passed gravel. At operation diverticular sac filled with stones and opening on the right wall and an extensive epithelioma of the base of the bladder were found. The diverticulum and epithelioma were resected, and the prostate which was also involved as removed. The patient died 3 years after the operation.

CASE 2 (A29093) A man, age 53, came to the Clinic on account of large amount of residual urine in the bladder requiring frequent catheterization. Operation revealed an operable epithelioma of the bladder and large diverticulum opening into the side of bladder. Patient died 3 months later.

CASE 3 (A240) A man, age 57, had been catheterizing himself daily for 6 months on account of residual urine. At operation the bladder was drained. A large diverticulum of the left wall was seen. Three months later the patient died, and at necropsy papillary carcinoma of the base of the bladder and large diverticulum of the left wall containing three large stones were found. There was also suppurative ureteropyelonephritis, and a left perineural bursitis.

CASE 4 (A34039) A man, age 64, had had frequency and dysuria for 3 years. Operation revealed three diverticula of the base of the bladder with an epithelioma extending over the mucosa of the prostate. The growths as enucleated the diverticula were not disturbed. The patient died 4 days after the operation. Necropsy revealed marked bilateral hydrocephalus.

CASE 5 (A348705) A man, age 63, had been troubled with frequency for 3 years. Operation revealed an area of necrosis and shallow diverticulum on the right base of the bladder the area of ulceration and the diverticulum were completely excised. One year later exploration of the bladder revealed inoperable carcinoma of the bladder. The patient died eight months later.

CASE 6 (A3799) A man, age 61, had been troubled with frequency and dysuria for 3 years. Operation revealed an area of necrosis and shallow diverticulum on the right base of the bladder the area of ulceration and the diverticulum were completely excised. One year later exploration of the bladder revealed inoperable carcinoma of the bladder. The patient died eight months later.

on the left, containing a stone. All the diverticula were removed transvesically. There was marked inflammation of the bladder which also contained three stones, each about 3 centimeters in diameter. A definite evidence of epithelioma of the bladder was found. The patient convalesced normally but symptoms returned shortly and 16 months later he died of epithelioma of the bladder.

Mortality. Englisch, in 1894, found that in 83.1 per cent of the reported cases of vesical diverticula the patients had died as a result of the condition. At this time very few operations were performed on the bladder and in most cases the diverticula were probably seen only in the late stages. In 1910, Fischer collected 48 cases in which, with and without operation 32 patients (66.7 per cent) died. Of 28 patients subjected to operation, 8 (40 per cent) died. In 1922, Kneise and Schulze collected 35 cases from the German literature and added 18 of their own in which radical operations were performed. Four patients (7.7 per cent of 52) died following operation.

The patients dying following operation for vesical diverticulum do not die from any constant cause. Practically all in whom the diverticula are of moderate or large size and are infected, have chronic nephritis and sometimes terminal acute nephritis.

#### DEATHS FOLLOWING EXCISION OF THE DIVERTICULUM

CASE 7 A man, age 60, had large diverticulum in which the ureter opened. The diverticulum was excised extravesically and the ureter tied and dropped back. The patient died on the fifteenth day. Necropsy revealed acute bilateral pneumonia and bilateral pyelonephritis.

CASE 8 A man, age 64, had a very large, thick-walled, adherent diverticulum. It was necessary to remove it in pieces extra-casally. There was much swelling of the surrounding tissues. The patient died on the twenty-seventh day from chronic interstitial nephritis and subacute pyelonephritis.

CASE 9 A man, age 33, had diverticulum as close to the bladder as possible and difficult to remove. It was removed extra-casally. The patient died on the twenty-seventh day of right pulmonary embolism, suppurative cystitis, and chronic nephritis.

CASE 10 A man, age 67, had large diverticulum in which the ureter opened. The diverticulum was excised extravesically and the ureter tied and dropped back. The patient died on the fifteenth day. Necropsy revealed acute bilateral pneumonia and bilateral pyelonephritis.

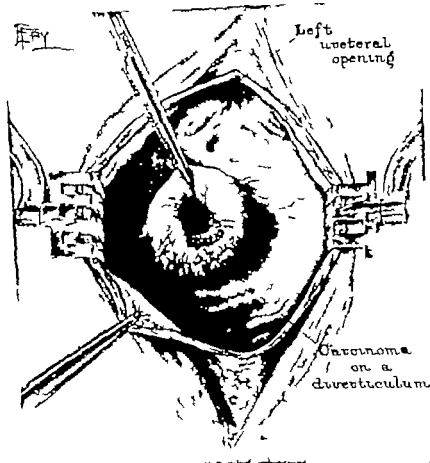


Fig. Carcinoma growing on border of diverticular outlet and extending down into sac.

phitis. The peritoneal cavity had been explored at the time of operation, and then closed. No evidence of peritonitis was found at necropsy.

**CASE 2:** A man, age 65, had a large thick walled diverticulum, adherent to the surrounding structures, and infected. It was excised extravesically. Following operation there was complete urinary suppression. Decortication of the kidneys was performed, and the right renal pelvis drained. The patient died 7 days later and necropsy revealed chronic nephritis, bronchopneumonia, and acute cysto uretero pyelitis.

**CASE 3:** A man, age 66 had a very large diverticulum, opening into the base of the bladder and also severe cystitis. Death occurred 3 days after excision of the diverticulum. Necropsy revealed acute and chronic nephritis, mechanical constriction and dilatation of the left ureter 1 centimeter from the bladder and chronic valvular endocarditis.

In the cases in which death occurred following palliative operations for the diverticulum the patients were critically ill and

In most cases only an emergency drainage of the bladder could be made. In all cases a marked infection of the bladder was present together with extensive destruction of the kidney. Two of the patients who died following a palliative operation also had carcinoma of the bladder and one carcinoma of the prostate.

#### SUMMARY

One hundred thirty three cases of diverticulum of the bladder were studied with regard to the type of operation performed and the postoperative results. One hundred thirty-one of the patients were men and two were women. Complete postoperative data were obtainable in 110 (83.9 per cent) cases. In 33 per cent the bladder contained multiple diverticula. Diverticula occur most com-

monly at the prostatic age 69.2 per cent of the patients were between 50 and 70 years of age. The most common location of the orifice is in the region of the ureteral outlet 87 per cent of 90 single diverticula were found in this location.

The diverticula were completely excised in 50 cases. Three patients (6 per cent) died. In 37 cases in which there was obstruction of the vesical outlet, the diverticulum was excised, and prostatectomy performed. Three patients died (8.1 per cent). In 46 cases the diverticulum was not removed.

The ureter was involved in the diverticulum in 5 cases. In 1 it was transplanted to a healthy portion of the bladder. In 4 cases in which the ureter was dilated it was ligated cut and allowed to drop back into the wound.

In 10 cases the diverticula were associated with stones. In 9 cases the calculi were in the diverticulum, in eight in the bladder and in 3 both in the bladder and in the diverticulum.

Carcinoma occurred in the diverticulum in 4 cases. Three of these patients died shortly after operation and the fourth died 2 years after resection of the diverticulum. In 6 cases carcinoma of the bladder and diverticula were found. Three of these patients died shortly after operation, one lived 16 months and one 3 years. The sixth had a recurrence 8 months after excision of the involved area.

Of the 6 patients who died following excision of the diverticula five died as a result of renal infection and obstruction in most instances they had both acute and chronic nephritis. The sixth patient died of pulmonary embolism; this patient also had chronic nephritis.

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THE INFLUENCE OF TRAVEL READING WRITING AND SPEECH MAKING ON THE PROGRESS OF SURGERY<sup>1</sup>

By SIR WILLIAM I. DE COURCY WHEELER, DUBLIN, IRELAND  
 President, Royal College of Surgeons of Ireland

I TAKE this opportunity of expressing my deep thanks and sincere feelings of appreciation for the great honor you have done me in electing me an Honorary Fellow of your College. I prize the diploma beyond words and my feelings cannot be adequately expressed. I offer you my humble thanks for the invitation from the Clinical Congress of the American College of Surgeons to attend these meetings, and for the high compliment of being asked to deliver the Fellowship address on the occasion of the tenth anniversary of the foundation of the College. I wish on behalf of my fellow visitors to acknowledge with no feigned gratitude, the spirit of brotherhood which has surrounded us on all sides.

Your distinguished past president, Dr John B. Deaver justly pointed out that the American College of Surgeons, though national in name is international in scope and that the College is carrying on the basic principles of the profession for the good of humanity. The activities of the American College in the direction of hospital standardization and public health are watched and followed by many far-off admirers. Ireland perhaps not least among them. We who are visitors from afar yet feel at home at this great Congress for the American College has demonstrated to the world the fundamental truth that medicine and surgery and for that matter scholarship generally are without nationality and know no distinction of race or of speech.

When I received by cable the invitation of the Regents of the American College of Surgeons to deliver this Fellowship address I was within 2 days of leaving Dublin. As it was, I felt ill at ease with the realization that my surgical papers for the meetings at Chicago and Iowa were burned and far from completion and that I would be standing for judgment before an assembly which in mere num-

bers would transcend anything to which I was accustomed and which in intellect and understanding would be composed of supermen in the world of medicine and surgery.

On occasions when I feel my heart sinking I go to my wife for aid. I received the encouragement which I expected. Take the plunge she says, the Regents of the American College have taken a greater plunge in selecting you. My courage was restored and in this connection may I quote to you a favorite passage from the opening words of an address by Sir James Barrie the creator of Peter Pan.

You have had many Rectors here in St. Andrew's who will continue to bloom long after the lowly ones such as I am are dead, rotten and forgotten. They are the roses in December. You remember someone said that God gave us memory so that we might have roses in December. But I do not envy the great ones. In my experience, and you may find in the end it is yours also, the people I have cared for most and who have seemed most worth caring for—my December roses—have been very simple folk. Yet I wish that for this hour I could swell into someone of importance so as to do you credit.

Irishmen have been all through history drawn toward America as if by some magnetic influence. I venture to say that the literature and the surgical work of America is as well known in Ireland as in America itself. To the pioneers and great contemporary workers in American surgery there is conceded a form of hero-worship in the Irish schools and as you know it is the proud privilege of the Irish College of Surgeons, over which I for the moment preside to possess as Honorary Fellows no less than 9 among the great surgeons of America today. It was an unheard of thing, during the 140 years of its existence for the Irish College to confer nine Honorary Fellowships on surgeons from the same land in one swoop. Only the names of those who are in the very forefront of the profession great leaders of science are suggested

<sup>1</sup>Fellowship address delivered at the Convocation of the American College of Surgeons, October 26, 1914.

to the College only those who are master pieces in the picture gallery of science are ever elected. We have charters, by laws, and ordinances which are as frowning battlements guarding our diploma. The governing body is composed of individuals who are human enough to hold strong opinions of their own and unanimity is difficult to expect and difficult to obtain. But when it came to the time to enroll the names of your retiring president, Dr. Cushing followed by the names of Drs. William and Charles Mayo, Dr. Oschner, Dr. Keen, Dr. Harte, Dr. Finney, Dr. Brewer and Dr. Crile there was not a dissentient voice and it is a phenomenal thing to have a meeting in Ireland with no dissention. Our predecessors who surrounded the Fellowship with barbed wire entanglements and fortified the approaches realized that from time to time such figures as I have mentioned would stand out as beacons in the great medical community and an opening was provided through which they could pass and be received with open arms.

It is natural that we in the surgical profession in Ireland give pride of place to American surgeons deep down in our hearts. Many of the greatest of them bear Irish names, blood is thicker than water and furthermore the donors and the recipients in the transfusion of the two races belong to the same group. "May the members of the medical profession of the two lands be joined in brotherhood for ever in the service of mankind."

Uppermost in my thoughts at the moment is the influence of travel, of reading, of writing, and even of speech making, on the progress of surgery and here I turn to the great American Oiler born in Canada, adopted by the United States, embraced by England and beloved by all. He refers to students who wish to have the best that the world offers. Let me suggest, says he, that the lines of intellectual progress are veering strongly to the West and I predict that in the 20th Century the young English physicians will find their keenest inspiration in the land of the setting sun. He had as well in Ireland have a love for the land where dreams come true, dreams of more secure reward for honest industry, dreams of freedom from the irksome restraints

and conventions which have outlived their day, dreams of equality not of the cap-in-hand apologetic kind but frankly avowed and sincerely prized equality which makes the exceptional truckling to rank by the few a subject of hearty laughter. I have quoted just now the words of my father-in-law who last year returned from America after a memorable experience as the guest of the American Bar Association. It was natural that he and I should discuss America and that brought us to the close connection which exists between medicine and the law and how they in turn are linked up from times immemorial with literature and the Church. What a combination of forces! what an irresistible army! brothers in arms defending the strongholds of science and learning allies taking the offensive against ignorance and error. Thus the Lord Chief Justice of England speaks of a great lawyer engaged in the work of the physician and surgeon in reconciling difficulties, in healing and preventing contention, and in making the wheels of the body politic move as smoothly as possible.

But let us for a moment return to the question of travel and peep again into the thoughts of Oiler. He deprecates contentment with second hand knowledge derived from books, he urges scientists to have a sense of obligation and to contribute to the stores from which they so freely draw and he pleads that by familiarity with workers abroad literature may be emancipated from crude and faulty observations. Those of us who live in a small island find it difficult to realize and to attach sufficient importance to these matters. It is very difficult even for an Irishman to live on an island and not to have an ular outlook, but difficulty is a severe instructor and we are learning from our difficulties well as from our mistakes. Just as soon you have your second teeth, says the medical philosopher, think of a change get away from the nurse, cut the apron strings of your old teachers, seek new ties in a fresh environment. With a great wide outlook he deprecates intellectual infantilism and that disease which is known as progeria in which, as if by the touch of the wand of some malign fury, the victim skips adolescence

maturity and manhood and passes to senility wrinkled and stunted a little old man among his toys. The rubbing of medical minds together is all for the good. Sometimes the process produces friction but the sparks and fireworks thus produced indicate a want of mental lubrication and a useful lesson is learned thereby.

With the limited vision which is given to one who lives and works in a small country two other diseases induced by the want of travel and of reading and writing became apparent. Have any of you great consultants in a big land seen cases of swelled head and writer's cramp developed sometimes from never using the pen? Curiously enough one condition resembles the other we know that writer's cramp is persistent and often cannot be cured and we deplore the fact that swelled head is seldom fatal. Ten years of successful work in a small place may tend to make a man touchy dogmatic intolerant of correction and abominably self-centered unless he seeks inspiration and enlightenment from his brothers abroad.

Travel reading and writing are as signposts pointing the direction of the straight road to scientific achievement and to legitimate success. Progress along the straight road is not easy. There are many Great hearts and Faithfuls who could recount the impediments and obstructions which they experienced on the way and tell of the bucketfuls of reprobation thrown in their path by those who resent the invaders of tradition.

With regard to writing I have seen men—some of them colleagues of my own in the surgical profession in Dublin—dictate without note or reference work of first importance in unsurpassed language and without previous thought. To others, like myself, writing is a grind a difficult laborious task and yet, there have been great men, like Swift who must have experienced the difficulties of humble contributors, for he gives the following advice to those about to write papers:

Blot out, correct, insert, refine,  
Enlarge, diminish, interline  
Be mindful, when invention fails,  
To scratch your head and bite your nails

Books and the printing press have accomplished wonders in helping forward the surging throng in search of truth. Journal literature and monographs are the literary rocks on which workers in medicine and surgery are content to stand. Textbooks fall by making mountains out of molehills and persisting in the retention of unwieldy classifications and bewildering names. I have been told that students in their final academic years by misdirected diligence in the lecture theaters and libraries sometimes were left uncertain whether such words as anaphylaxis and prophylaxis were medical terms, or the pet names of Russian and Grecian generals.

May I tell you something in relation to medicine, literature and travel among the ancient Irish? Much of the ancient medical history of Ireland is traditional and legendary but the people in bygone days were not devoid of literary culture. In the *Book of Genealogies* of MacFhiris there is mention of one Eaba, a female physician (Medical women were not peculiar to Ireland for we learn from Tacitus that the women followed the German army for the purpose of dressing the wounds of the soldiers upon the battlefields.) In still earlier ages women practiced medicine, for in Blackie's translation of the *Iliad* we read

A leech was she, and well she knew  
All herbs on ground that grew

It is interesting to note that the Royal College of Surgeons in Ireland was the first modern licensing corporation in Great Britain and Ireland to admit women and to appoint them to the highest office in its gift. There is no paucity of isolated references to Irish medicine in ages past. The *Book of Lismater* records the tragic fate of Conchobhar Mac Nessa, King of Ulster who died A.D. 37 and relates that he was wounded in the head by a missile from the sling of one of his enemies and was attended by a physician named Fingen. Fingen "could know by the fume which rose from a house the number that was ill in the house and every disease which prevailed in the house. The King's head was stitched with threads of gold because the color of Conchobhar's hair was the same as gold.



The ancient laws of Ireland the Brehon laws codified at the request of St. Patrick, A.D. 438 refers to the remuneration and responsibility of medical men. If one person wounded another the aggressor not only was obliged to pay a fine to the injured one but provide him as well with maintenance and skilled medical care. What a pity the Brehon laws are not still in force.

The profession of physic passed from father to son an Irish custom which persisted until comparatively recent times. The ancient Irish doctor was shrewd enough to travel. He found inspiration in the work of his foreign colleagues, and taught posterity an important lesson thereby. Representative Irishmen of all professions remained abroad, and were found occupying distinguished positions in the various schools of Europe.

Ancient manuscripts prove how admirably Irish physicians kept in touch with the advances of learning in Continental centers. A thirst for knowledge augmented by a keen observation of the sick under their care brought medical and surgical science to a high pitch of perfection in the Ireland of bygone days.

Toward the end of the 6th Century progress came to a standstill. Science and art decayed. Ireland was torn by strife and warfare appears to have been the order of the day. No shelter for learning remained, and the old worthy position held when Egyptian, Grecian and Roman thought dominated the world, was lost to Ireland for a time. This relapse was intensified by the failure of the Irish to grasp the revolution in learning brought about by the printing press. The art of printing was neglected until nearly 100 years after its adoption by the progressives of other lands. The early printed records of the great European physicians were no longer imported by the Irish; the door was shut to the knowledge freely disseminated and eagerly grasped elsewhere. No Irish medical literature existed in print at this time and there was little to encourage men of ability to remain for study or to practice medicine in a decadent land.

This was a distressing period for Irishmen to contemplate but soon came a reaction and

we turn over the pages of medical history to find after 100 years, the names of Colles, Graves, Stokes, Corrigan, Butcher, Tufnell and many others.

In recent years Irish surgeons and physicians have been engaged in a heart-breaking struggle in their efforts to advance. Lethargy, inertia, and poverty—the common legacy of the great war—are in some measure to blame but lack of interest and enthusiasm on the part of the people and of the rulers whom they elect in the working of the medical machine, has crippled the machinery and the driving force has gone. This brings me to the antagonism which exists between the ideals of the medical profession, on the one hand and the ideals of the politicians, on the other. The term politicians does not include those great statesmen to whom the very life of liberty now and in the past, owes its existence nor does it apply to those unostentatious, whole-souled individuals who give their lives to the public service. I use it in the broadest sense to include those whom the world would be better without.

After all our outlook on life from the time we enter the medical school until we pass on into silence is entirely different from the view taken by politicians and their cult. Whether we are biologists or craftsmen we try to keep on a path which takes a direction through accurate observation and logical reasoning to the goal of scientific truth. The byways of political life on the other hand are often paved like another road—with good intentions but lead through a jungle of words and sentences, to ambiguity and nowhere. Modern statecraft appears to be based on the belief that the world can assimilate only minimum doses of truth at a time that a big dose is dangerous and that the public should be cured of political ills by homeopathic methods. "I always hold," said Mr. Gladstone, "that politicians are the men who as a rule are the most difficult to comprehend."

The American College of Surgeons has surrounded our College in Ireland with many tokens of attachment. If the "time whistle" is not about to blow, I will tell you something of our College life. When the College of Surgeons in Ireland was born in 1783 political

upheavals were the order of the day. There was a declaration that the Irish law courts were independent of England. There was a convention of all the Volunteer Corps in Ireland to obtain Parliamentary reform. So it went on for 140 years to the present day but on recent events I need not touch beyond this that we in the College are trained to be optimists, and to assume that, until a patient is dead, our efforts at treatment will be rewarded by success. Our optimism extends to a profound belief in our own country and that the present ship of State will be steered into peaceful and happy channels.

Few institutions in Ireland can claim a record such as ours over 140 years. Many of them were planted with great promise and then withered away. Leckie once said that

Irish institutions often fell mowed with corruption, sometimes torn to pieces by sectarian strife and sometimes they have perished through the constant fluctuations and vicissitudes which have so peculiarly characterized the Government of Ireland.

If anyone should ask me how it is that this College of ours has survived in a robust condition through all the storms and passions of the past and present I would say—because it rested content in strictly attending to its own affairs. Our attitude of old like that of one of your great statesmen today can be summed up in the lines

"A wise old owl lived in an oak,  
The more he saw the less he spoke  
The less he spoke the more he heard  
Why can't we all be like that bird?"

Since our College Ship was chartered by King George III on the 9th of March 1784, the pilots have been charged with the definite duty of steering for surgical progress through the seas of culture, of learning of literature and of science. Storms and thunders in the surrounding atmosphere may have shaken our hopes but the course of the ship was never deflected by a single degree. The College is possessed of peculiar powers of vision. It has been color-blind since the day it was born and, in consequence is unable to distinguish one political color from another and in questions of sect it either sees double or prefers to become totally blind.

We have no politicians in the mischievous sense in the College of Surgeons in Ireland. We have no classes and cliques, such as brought forth the following lines from the late Lord Fisher

We are God's chosen few,  
All others will be damned  
There is no place in heaven for you—  
We can't have heaven crammed

We regard politics, medicine and surgery as an incompatible mixture which produces an explosion and which has no place in our College pharmacopoeia. Thus we in the medical profession in Ireland, while sharing risks and dangers, have been allowed to remain comrades and to live in peace.

With regard to speech making I have little to say. It is a forcible means of propaganda if used fairly in spreading the light of learning and of justice. It is a power which in the hands of some may be the means of far reaching mischief and bring about irretrievable harm. I have read that the faculties of speech and of speech making are essentially diverse by the one, says the writer you make yourself intelligible, and by the other unintelligible to your fellow beings, and in poking fun at his friends in America, the author adds that Speech making is one of the greatest of American institutions. The machinery of celebrations requires it, a creak or two notwithstanding but you would as little mention the creak as allude to the top notes of the Star Spangled Banner.

Twenty five years ago I used to wonder if a time would come when I could face an assembly as a speaker without tachycardia or as my learned teachers in those days would say with a proper co-ordination of my visual, auditory, graphic, and articulatory centers. The time has never come, and on rising to speak, to this day I feel like the man who returned to his hotel and forgot the number of his room and the name of his wife.

I remember well my first attempt. I was on the agenda to deliver an address to a students association in Trinity College, on the subject of a bear's skull. The specimen was obtained during the excavation of some caves in the West of Ireland, and was given a present to my father. Political feeling was, as

usual, running high, and I expressed the view as an expert geologist, that the bear to which the skull belonged lived contemporaneously with the primitive politicians in the West of Ireland and that it was hard to see if we believed in Darwin why the politicians survived and the bears became extinct.

America has taught us the power of self reliance we have felt the influence and have been stimulated by the example. Self reliance power of initiative fearlessness of responsibility and fertility of resource has placed the American College of Surgeons in ten short years on a pinnacle of power surrounded by the respect and admiration of the profession in every land.

I bring you fraternal greetings from the medical profession in Ireland on your tenth birthday and the hope that as one decade follows another you may continue with ever increasing momentum to advance and prosper until finally your great efforts will triumph over the diseases which are decimating mankind and that you will be crowned by humanity itself with the laurels which belong to Victory.

Fellows of the American College of Surgeons I beg to express the good fellowship of the Royal College of Surgeons and leave you tonight with

"Memories, images and precious thoughts

That shall not die and cannot be destroyed.

THE RELATION OF THE ENDOMETRIUM TO OVARIAN FUNCTION<sup>1</sup>

BY CHARLES C. NORRIS, M.D., F.A.C.S., AND M. VOGT, M.D., PHILADELPHIA

THE writers believe that the endometrium possesses a definite endocrinal function and that this function operates in conjunction with the secretory function of the ovary and is probably subvenient to the latter. There can be no doubt but that the ovary is the dominant endocrinal factor of the female genital tract. It is equally apparent that the ovary functionates with other endocrinal glands, as for example the thyroid. It appears almost certain that an interrelationship between the ovary and the endometrium exists, and that one structure is to some extent dependent upon the other.

Blair Bell was formerly of the opinion that the endometrium elaborated an internal secretion but he subsequently discarded this view. Zweifel and Abel, Doran,<sup>2</sup> Oliver,<sup>3</sup> Bond,<sup>4</sup> Lowenthal and others are of the opinion that the endometrium possesses an endocrinal function. Whether or not the endometrium possesses an endocrinal function is a difficult problem to solve with certainty. The results achieved by animal experimentation are by no means uniform or conclusive for the estrous cycle in animals differs in so many respects from the menstruation of women. Certain phylogenetic evidence refutes the theory since the uterus is an organ that appeared comparatively recently in the course of vertebral evolution. However many clinical facts point strongly toward the existence of an endocrinal function in the endometrium and recently as a result of the employment of radium in the treatment of so-called benign hemorrhages, a large amount of additional clinical data have become available.

The importance of this question is at once apparent to the gynecologist and surgeon and is of particular interest in view of the newer methods of treating uterine myomata by radiumization. It has moreover a distinct

bearing upon the widely discussed topic of the relative merits of supravaginal hysterectomy and panhysterectomy as well as upon the advantages of myomectomy. With this in mind, we submit the following evidence bearing upon the subject.

Perhaps little can be learned from the histological study of the endometrium. Nevertheless, the marked activity of the epithelium of the endometrium and the large amount of gland-like stroma present during the active sexual life of the female are at least suggestive. The fact that the endometrium differs structurally from other endocrinal glands does not disprove this theory since all the endocrinal glands are histologically dissimilar and the evidence of their function is based almost entirely upon physiological and clinical findings.

The end results that develop in patients subjected to supravaginal hysterectomy with conservation of the ovaries are extremely suggestive. A careful study of the after histories of some 300 such cases shows that about 15 per cent menstruate scantily but regularly. These patients show the best end results. There is a longer period before the occurrence of the menopause, and the nervous symptoms incident to the climacteric are less pronounced, simulating more closely those of the normal menopause. These patients enjoy a longer functioning ovarian life. In a second group the patients at once cease to menstruate, and no nervous symptoms develop or the nervous symptoms of the menopause set in gradually some years after operation but usually a few years earlier than in normal unoperated upon women. This group constitutes about 65 per cent of hysterectomized patients upon whom ovarian conservation has been practised. A third group of patients cease to menstruate at once and immediately or very shortly after develop definite menopausal symptoms. This group comprises about 20 per cent of all patients subjected to this form of operation.

Zweifel and Abel, *Zucker's Gynaec.* 1904, No. 11.

Doran, *Lancet*, Lond. 1903, Nov.

<sup>2</sup> Oliver, *Lancet*, Lond. 1904, 8, 1904.

<sup>3</sup> Bond, *Brit. Med. J.* 1904, July.

Lowenthal, *Arch. f. Gynaec.* 1901.

The explanation for the end results in the first group is that the uterine amputation has been performed at a high level and that functioning endometrium has been preserved. As regards the second group it must be remembered that not infrequently normal unoperated upon women are free from nervous symptoms at the menopause or that a gradual atrophy of the ovaries may occur due to operative interference with their circulation a condition that finally results in cessation of the endocrinal function. A more plausible explanation is that there is a gradual disappearance of the function of the ovary due to a lack of interrelationship with the endometrium which has been removed by operation. In explanation of the third group which develop menopausal symptoms immediately or very soon after operation it may be stated that this result is due to lack of function of the ovary. This group constitutes at least 20 per cent of all cases operated upon. If the nervous phenomena that occur in all of the members of the third group and in many of the second group were the result of ovarian degeneration incident to operative interference with the circulation of the ovary it would appear that palpable finding or painful ovaries should be present in equal proportion to the menopausal symptoms. Such, however is not the case and the cystic degeneration is relatively infrequent. This disproportion will be very striking in all the series of such cases that are studied carefully.

In our own series of 171 cases in which the ovaries were conserved not a single patient required a second operation for degenerative changes in the ovaries and at the meeting of the American Gynecological Society at which our report was read Culbertson reported similar results in a still larger series. In our series the menopausal symptoms developed so much more frequently than did palpable or painful changes in the ovary that one is almost forced to believe that there must be a definite interrelationship between the ovary and the endometrium. Results that resembled these led Zweifel and Abel to draw

similar conclusions. These results may perhaps be explainable on the ground of a gradual ovarian atrophy due to the circulatory disturbances incident to hysterectomy. It is generally conceded that the changes in the ovary due to operative interference are manifest by cystic degeneration. This is always painful and can readily be recognized by palpation. For these and for other reasons we are inclined to look elsewhere for the explanation of why so relatively large a proportion of hysterectomized patients in whom one or both ovaries have been conserved suffer an early or exaggerated menopause. Graves is of the opinion that if the uterus is removed an oophorectomy should also be performed and that, in the absence of the uterus the ovaries become functionless. We believe that, aside from its function in reproduction the menstrual cycle has a marked effect upon the woman during her active sexual life.

All surgeons have observed the atrophic changes in the genital tract that follow bilateral oophorectomy. The nervous and psychic changes of the normal menopause are exaggerated in nervous or young women by any operation that tend to arrest the menstrual flow. Mayo<sup>1</sup> states that the effect upon patients is essentially the same whether menstruation is checked by removal of the ovaries and retention of the uterus or removal of the uterus and a conservation of the ovaries. He adds that he believes that menstruation itself has an important endocrinal function. Although we do not consider the uterus so important as the ovaries in the economy of the woman a view such as that just expressed concerning as it does from a careful observer must be given due consideration. Our experience has been that ovarian conservation is of distinct value even when the entire uterus is removed but that the ovaries function more satisfactorily if a part at least of the endometrium can be spared. In cases of bilateral salpingectomy with ovarian conservation the artificial menopause does not occur. If however the uterus is removed a certain proportion of patients will be found to develop the nervous phenomena that are incident to

<sup>1</sup>Clark, J. O. and North, C. C. *Surg. Gynec. & Obst.* 1922, 35: 579.

ovarian afuction. Analogous results have been observed by comparing those patients on whom a myomectomy has been performed with those in whom a supravaginal hysterectomy with ovarian conservation has been practised. The former do not suffer from menopausal symptoms whereas they are present in a proportion of the latter. In other words as soon as the endometrium is removed, a definite proportion of patients will be found to suffer from menopausal symptoms.

No one who has examined a large series of uterine myomata would fail to be impressed by the relatively large proportion of specimens that exhibit greatly thickened or even polypoid endometria. Histologically such endometrium is frequently found to be of the premenstrual or early menstrual type. It is probable that the permanent premenstrual character of the endometrium is due to stimulation of the mucosa by the presence of the tumor. This in turn we believe stimulates the ovary by the internal secretion of the former and accounts for the frequency with which hypertrophied ovaries occur in conjunction with these neoplasms.

Bleeding of the menorrhagic type is one of the most frequent and pronounced symptoms resulting from uterine myomata. In some cases the bleeding may be accounted for on a purely mechanical basis. In many cases, however this explanation is untenable. The mechanical theory may account for an increase in flow during the menstrual period, but it would seem that the prolongation of the flow which is so often a prominent feature, must be due to the long continued stimulation that starts the bleeding. Furthermore many cases in which there is no submucous tumor bleed excessively.

Kroes<sup>1</sup> as a result of animal experimentation leans to the belief that the uterine secretion contains a substance that delays coagulation and dissolves blood clots. This author is of the opinion that his experiments justify the theory that abnormal uterine bleeding not accounted for on anatomical grounds i. e. due to neoplasms, etc. can be ascribed to the deviation from the normal physiology of the secretion formed by the endometrium.

An examination of our specimens of uterine myomata shows that in bleeding cases the endometrium is usually of the thickened premenstrual type unless actual invasion of the uterine cavity by the growth is present even in this case that portion of the endometrium not subjected to pressure often exhibits this change. Certainly the mechanical theory does not apply to all cases. If we accept the theory of endocrinal function of the endometrium a ready explanation is at hand. In those cases of diffuse adenomyoma of the uterus the mechanical theory is still less acceptable. These patients all most always suffer from menorrhagia practically all exhibit the thickened premenstrual type of mucosa and in addition, the uteri contain considerable endometrium-like tissues in the depths of the myometrium. The endocrinal theory offers a probable and perhaps the most satisfactory explanation in this case.

The strongest argument for the theory that the endometrium possesses an endocrinal function is probably found in the study of patients who have been subjected to radiumization. In 94 per cent of cases 1000 millicurie hours of radium applied to the interior of the uterus checked all uterine hemorrhages due to small or medium-sized myomata and other so-called benign bleedings.<sup>1</sup> For these cases radiumization may be considered almost specific. Its chief disadvantage is that when applied to women who still menstruate, it produces a severe artificial menopause. This fact is so well recognized that in young women most gynecologists prefer to practise supravaginal hysterectomy with conservation of the ovaries unless the more radical operative intervention is contra indicated for some other reason. In the radiumized patient the menopause is quite as severe as that which follows a panhysterectomy and bilateral salpingo-oophorectomy. Two theories as to the manner in which radium checks hemorrhage in these cases have been advanced. One that the rays prevent the development of the ovarian follicles in other words castrates the woman and the other that the action of the rays is merely local, affecting only

the uterus and the tumor. Fully I inclined to believe that both theories are correct.

The recent experimental work of Weiss would indicate that radium produced only a local effect. Even if we assume that by its action on the ovarian follicles it does destroy the functioning power of the ovary, it is almost impossible considering its limited range of effectiveness to a time that in 94 per cent of cases one dose would in every case destroy the function of the ovaries. This is particularly the case when we recall the abnormal position often occupied by the ovaries in cases of uterine myomata. It would seem extremely likely that in more than 6 per cent of cases one ovary at least would be so far removed from the seat of radiolumination that it would escape the action of the rays. If in these cases the arrest of the hemorrhage is due to the local destructive action of radium on the uterus and the tumor it is convincing evidence of the endocrinal function of the endometrium. If we accept the endocrinal theory the results are in either case not explainable.

All other things being equal it is therefore preferable when performing hysterectomy with conservation of one or both ovaries, to preserve a portion at least of the endometrium. In many cases this course is eminently practical. Histological and bacteriological examinations have shown that the leucorrhea due to cervical infections originates chiefly from the lower half of the cervix which is not generally removed by supravaginal hysterectomy. In 80 per cent of cases carcinoma of the cervical stump arises from squamous epithelium and even more rarely from the upper part of the cervical canal. The incidence of carcinoma of the cervical stump is therefore not materially decreased by a low supravaginal amputation. In many cases of supravaginal hysterectomy it is quite possible and advisable to perform the amputation at quite a high level. Moreover this facilitates the operation. We believe that even if all the endometrium is removed the conservation of an ovary is still of value but that the ovary functions better if a portion at least of the endometrium can be preserved.

It is probable that the endocrinal action of the endometrium fluctuates with the menstrual cycle just as the function of the ovary varies and that its greatest activity is in the premenstrual stage—the stage that is so often found permanently in bleeding myomata.

The preceding work is presented in the form of a preliminary report. As has been stated the theory attributing an endocrinal function to the endometrium is open to doubt although clinical evidence is strongly corroborative. We hope soon to be able to present the results of the experiments bearing upon this subject. If it can be definitely proved that the endometrium function as an endocrinal gland many problems hitherto perplexing will be solved. It is possible that the nausea that occurs during radiolumination of the uterus as well as other conditions such as certain of the dysmenorrheas that so often occur in patients with normal ovaries, the nausea of early pregnancy etc., may be accounted for by assuming the endocrinal action of the endometrium.

#### CONCLUSIONS

1. The theory that the endometrium possesses an endocrinal function is at present based only upon physiological and clinical proof. The fact that the endometrium differs histologically from other endocrinal glands is no argument against the theory since all other endocrinal glands differ one from the other in this respect.

2. The endometrium probably possesses a definite endocrinal function which like other endocrinal glands, acts in conjunction with certain so-called ductless gland particularly the ovary to which it is most likely subservient.

3. The endocrinal function of the endometrium probably fluctuates with the menstrual cycle being most active during the premenstrual period.

4. The chief clinical evidence on which this theory is based lies in the established fact that the proportion of women who suffer from nervous phenomena after a hysterectomy with conservation of one or both ovaries is much greater than that of those who exhibit painful or palpable changes in the conserved ovary.

5 The most conclusive evidence is found in those patients who have been treated with radium for the arrest of benign hæmorrhages. It is difficult to conceive that in almost every case so treated both ovaries are rendered functionless. Furthermore there is much experimental evidence that tends to show that in these cases the action of radium is limited to the uterus.

6 In operations upon the uterus ovarian conservation is of distinct value even if pan-

hysterectomy is performed the ovaries function better however and have a longer functional life if a portion of the endometrium can be preserved.

7 The thickened and permanent premenstrual stage of the endometrium so frequently present in patients suffering from uterine myomata, is the result of stimulation of the endometrium by the presence of the tumor and accounts for the prolonged bleeding that is often present.

## LATE ULNAR NERVE PALSY

By EDWIN M. MILLER, M.D. CHICAGO

THE lesions of peripheral nerves associated with fractures are generally classified according to the time at which the signs of nerve involvement appear namely primary secondary and late. The primary lesion occurs at once at the time of injury but is often overlooked only to appear after removal of the splint or dressing. It may vary in severity from a simple contusion of the nerve trunk to a complete anatomical division. The secondary lesion comes on gradually during the weeks of bone repair and is due as a rule to a stretching of the nerve over growing callus or displaced bone fragment pinching between the ends or bone fragments or its inclusion within callus or scar tissue. Whatever its cause may be the lesion is apt to be permanent unless surgically relieved. The late paralysis is peculiar in this respect that it makes its appearance many years after the fracture occurs and in some instances long after the accident has been forgotten. It is to this type of lesion that the author will confine his remarks.

Panas (10) in 1878 was the first to call the attention of the medical profession to this clinical picture. To his clinic came a cobbler about 40 years of age complaining of wasting of the muscles of his right hand so that he had difficulty in using his hammer in the mending of shoes. Many years before he had broken his arm at the elbow but aside from a de-

formity at his elbow it never gave him any trouble until 6 months before coming to the surgeon within which time a complete ulnar nerve palsy had developed.

It was not until 1898 however that Albert Mouchet (7) in his doctor's thesis at Paris completely analyzed this clinical picture, clearly demonstrated its most common etiological factor and submitted a rational method for surgical relief of the paralysis. Since that time there have appeared many notable papers in France by Mouchet and Broca (8) Guillemin and Mally (3) LeClerc (6) Redard (12) and Sengenase (13) in Germany by Siegfried Peltzsohn (11) and Staffel (17) in England by Sherren (15) and Bowlby (1) and in this country by Ramsay Hunt (5) Murphy (9) and Walter Shelden (14).

From a careful analysis of this literature and from a direct study of clinical cases the following facts may be set down as being characteristic of this clinical picture.

1 The primary cause in practically all cases of late ulnar nerve palsy is a fracture at the elbow in childhood, usually between the third and fifth year.

2 Although occasionally the site of injury may be at the internal condyle or in the supracondylar region, in the vast majority of cases the line of fracture begins laterally just below the epicondyle and passes ob-



liquely downward and inward into the joint, causing a complete separation of the external condyle (capitellum)

3 The broken capitellum is displaced laterally and forward and the fractured surface is twisted outward, is not accurately reduced by manipulation, and as a result non union of the condyle occurs. The growth of the humerus on its lateral side is thus interfered with to such an extent that a cubitus valgus gradually develops

4 As the deformity increases the olecranon process becomes impinged against the medial condyle the ulnar groove becomes but a shallow depression and the nerve itself is placed from its bed, where it becomes subjected not only to stretching when the arm is flexed and extended but to repeated slight trauma which in time lead to partial or complete ulnar palsy

5 This paralysis may begin as early as 3 years or as late as 40 years after the injury but in the majority (40 per cent) of cases it is noticed between the twentieth and thirtieth year after the fracture occurs

The method of treatment after the palsy has developed may be grouped under the following heads

1 Correction of the deformity at the elbow by a cuneiform osteotomy of the humerus no operation on the nerve itself being necessary

2 Simple liberation of the nerve from its bed

3 Liberation of the nerve at the elbow and replacing it in a new groove made by removal of a wedge shaped piece of bone and lining it with an aponeurotic fascial flap

4 Transplantation of the nerve to the flexor side of the elbow

Each of these methods has received the enthusiastic support of noted surgeons Mouchet himself after carefully weighing the merits of each, chose the first and his clinical end results, in a small series of cases, bear out the wisdom of his judgment. Simple liberation of the nerve, though often tried has been shown to be insufficient, in that it fails to change the etiological factors. Deepening of the ulnar groove though theoretically correct and used with good results by Broca

and Guillemain and Malliv is open to the objection that regeneration of bone may fill the deepened groove and that the nerve may become easily involved in scar tissue. Of all the methods the latter best stood the test of time and in this country has been the most popular method of treatment

The author desires to present the following cases, most of which have come under observation at the Presbyterian Hospital

CASE 1. F. H. male age 32. At the age of 7 years he fell and fractured his right elbow. The fracture repaired in due time and he suffered no ill effect from the injury except for a deformity at the elbow until he was 20 years of age, when he noticed numbness and tingling along the little finger distal to the edge of the hand, which was relieved somewhat by massage. After about 3 months the numbness ceased and the real numbness became quite numb. There has been a gradual wasting of the muscles of the hand. The condition was aggravated in turn by an injury to the elbow in railroad wreck about 1 year after the onset of the symptoms

He was admitted to the Presbyterian Hospital, November 22, 1911, presenting a typical picture of ulnar nerve paralysis with marked muscle atrophy. At operation, performed by Dr. C. J. Rowe, the ulnar nerve was found on the outer or the prominent internal condyle of the humerus. The ulnar groove was very shallow. The nerve freed, and placed in a new groove made by chiseling out a wedge shaped piece of bone

Within 3 months improvement in the condition of the hand was noticed, and the progress was continuous for about 3 years after which time he took up golf to aid in the development of the muscles of the hand

When examined by the author April 29, 1912, there was marked cubitus valgus, and thickening in the region of the prominent internal condyle. The ulnar condyle freely movable. The ulnar nerve could be felt in the groove and as it was rubbed under the finger a tingling as felt along its sensory distribution in the hand. There was crepitus at the elbow on motion. Atrophy of the muscles of the forearm or hand was noted. Opposition of the little finger was normal. Adduction and abduction of the fingers were present but weak. Adduction of the thumb was normal. There was no disability for ordinary uses of the hand, and playing golf the grip was strong. The only thing he noticed was slight tingling sensation times in the ring and little fingers

Case 2 (Fig. 1) male at the time showed an old ununited fracture of the external condyle of the

The first four cases were included in the report on "Ulnar Nerve Lesions Associated Fractures," by David Lewis and Edwin M. Moberg published in full in the Transactions of the American Surgical Society, 1912



Fig. 2. Case. Ununited fracture of external condyle in childhood. Cubitus valgus. Ulnar nerve palsy beginning 3 years after injury.



Fig. 3. Case. Ununited fracture of external condyle in childhood with growth disturbance resulting in marked cubitus valgus and complete ulnar nerve palsy.

humerus which was markedly atrophied, several small loose bone fragments near the medial condyle and a marked cubitus valgus.

The result in this case is as striking as any that have been reported following this type of operation, and in view of the long duration of the paralysis is remarkable.

CASE. J. W. male, age 4. At the age of 4 years he fell while playing and sustained a fracture of the left elbow, which was reduced at once and healed with slight deformity in normal time. About 3 years later a slight wasting of the left hand was noticed by his parents and he was given instruction in the violin, with the sole purpose of developing the wasting muscles, and he achieved some degree of success. He played constantly until the time he entered the army service but had difficulty with the ring and little fingers on the A and E strings. The deformity caused him very little inconvenience but he has carefully guarded the point of the elbow as a slight blow in that region practically paralyzed the hand for 15 or 20 minutes. If the arm was kept bent for any length of time as in sleeping, reading, carrying the hand in his pocket or leaning upon a desk, the hand became quite cold and numb in lifting or carrying a weight, most of the strain fell upon the middle finger as the ring and little finger were quite useless.

X-ray (Fig. 2) made March 16, 1923, showed an old ununited fracture of the external condyle of the humerus which was markedly atrophied. There was also atrophy of the radius, and an extreme degree of cubitus valgus. On the medial side of the elbow there were apparently two loose pieces of bone, one about the size of an olive and the other the size of a kidney bean.

Examination on March 6, 1923, when he entered the Presbyterian Hospital, showed extreme ulnar

nerve palsy with marked muscle atrophy. The ulnar nerve felt enlarged where it passed behind the prominent medial condyle in its shallow groove. When it was rolled under the palpating finger a tingling was felt in the ring and little fingers. In view of the long standing paralysis and extreme muscle atrophy relief by any operative interference was not considered at all probable, but owing to the insistence of the patient the operation was performed March 16 under local anesthesia.

Through an incision along the flexor aspect of the medial condyle the ulnar nerve was exposed for a distance of 6 inches (Fig. 3, A). When the covering of deep fascia was incised the nerve seemed to bulge into the wound as if it had been punched beneath the shallow groove and overlying dense fascia. It was red gray in color, edematous, and enlarged fully twice the normal size as it ran down as its entrance into the flexor muscles. With an aneurysm hook it was gently lifted from its bed (Fig. 3, B), freed from the adherent connective tissue, and placed along the flexor aspect of the medial condyle above the deep fascia where it was tacked by folding over a very thin layer of areolar tissue in two places (Fig. 3, C). After closing the skin with silk, the arm was placed in a sling.

CASE 3. J. H. male, age 46. Forty years ago he fractured the left elbow. He does not remember having any trouble with the arm, except for occasional cramps, until about 36 years later when he took up golf. He noticed that the grip of the left hand was a little weak and that he was holding the shaft of the club with the tip of the thumb rather than the proximal part. Later on he noticed wasting of the muscles of the back of the hand and the cramp-like pains became more constant. He presented himself at the Presbyterian Hospital in 1919, on the service of Dr. Carl Davis, with complete ulnar nerve palsy.

At operation the nerve was exposed through a median incision. There was a bulbous enlargement and the nerve was adherent in scar tissue. The adhesions were freed, the sheath opened, and a small adherent neuroma seen. This was freed from adhesions but not removed.

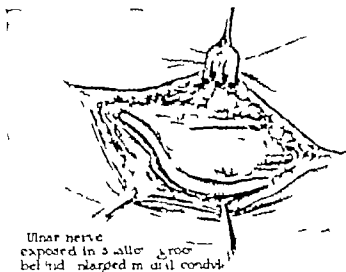


Fig. 3A. Ulnar nerve exposed in shallow groove below enlarged medial epicondyle.

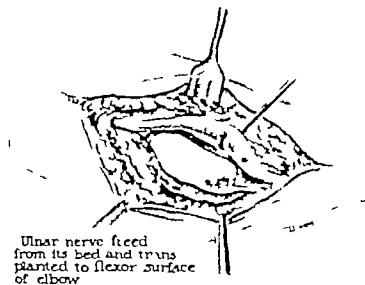


Fig. 3B. Ulnar nerve freed from its bed and transplanted to flexor surface of elbow.

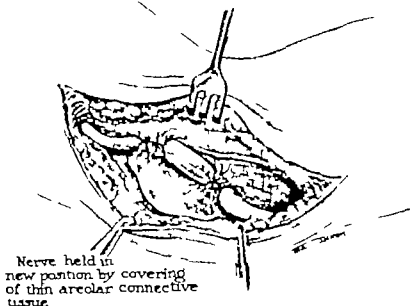


Fig. 5C. Nerve held in new position by covering of thin areolar connective tissue

The X-ray made at the time of operation (Fig. 4) showed an old ununited fracture of the external condyle with extreme cubitus valgus. The loose condyle and upper end of the radius were re-attached.

**Result.** The patient states that about one year after operation the pain began to subside. When seen by the author in 1936 he was entirely free from discomfort. There was occasionally a tingling along the edge of the hand and little finger, but the sensation over the ring finger has returned to normal. The muscle atrophy still remains, although the disability for ordinary use is slight.

**CASE 4.** D. P. At the age of 10 years he fell and broke the left elbow. He remembers that the surgeon spoke of it as "T-shaped fracture" that the flesh was torn so that the bone protruded and that it was about 6 months before the wound was entirely healed. At the age of 18 years he fell and broke the same elbow again. The X-ray were made but the fracture repaired in normal time and he had good function in spite of a gun stock deformity. About 5 years later (at the age of 33 years) while a medical student in the dissecting room he first noticed pain in the ring and little fingers when the elbow was held in the flexed position for long time. This gradually became more noticeable and within 8 months he had developed almost a complete ulnar nerve palsy. An X-ray (Fig. 5) made in March, 1920, showed an old fracture involving the region of the capitellum and also the trochlea. Both of these and two small fragments in the region of the olecranon fossa appear to be un-

ited to the supracondylar portion. A cubitus varus is present. A letter from this patient April 11, 1932, says, "At present there is partial anesthesia and loss of sensation of pressure over the ulnar side of the hand, little finger and exactly one half of the ring finger." The motor function of the nerve seems almost unimpaired, except that the adductor pollicis and interossei are atrophied. One can feel the thickened nerve at the elbow.

This case differs from the others in that a gun stock deformity existed rather than a cubitus valgus. The late involvement of the ulnar nerve was evidently due in this case to the nerve having been displaced from its normal groove at the time of the fracture and exposed to long-continued trauma.

**CASE 5.** B. B. female age 30 years. When child he fell while playing and broke the right arm at the elbow. After healing had occurred she had no trouble with the arm until about 8 years later when she began to have tingling sensations along the ulnar side of the hand and fingers. A weakness of the hand gradually developed and within a year complete ulnar nerve palsy was present.

Upon entrance to the Presbyterian Hospital an X-ray (Fig. 6) showed an old ununited fracture of the external condyle of the humerus with marked cubitus valgus. The loose condyle was much atrophied and displaced anteriorly and laterally.



Fig. 4



Fig. 5

Fig. 4. Case 3. Ununited fracture of external condyle in childhood. 17th resultant cubitus valgus. Ulnar nerve palsy beginning 20 years after injury.

Fig. 5. Case 4. Compound fracture involving the external condyle of the humerus in boyhood resulting in gunstock deformity of the elbow. Onset of ulnar palsy 23 years after the injury.



Fig. 6



Fig. 7

Fig. 6. Case 5. Old ununited fracture of the external condyle of the humerus in childhood. 17th development of cubitus valgus and ulnar nerve palsy beginning 18 years after injury.

Fig. 7. Case 7. Ununited fracture of external condyle 1 year of 4 years. Cubitus valgus. First signs of ulnar nerve palsy beginning 5 years after injury.



Fig. 8



Fig. 9



Fig. 10

Fig. 8. Case 8. Old ununited fracture of external condyle of humerus. 4 years of age. Marked cubitus valgus and shallow ulnar groove. No evidence of ulnar palsy at present.

Fig. 9. Case 9. Fracture of external condyle of humerus at 4 years of age. Union of fragment to shaft did

The ulnar groove was very shallow. The patient was operated on February 9, 1913 by Dr. Phemister who found the ulnar nerve to be flattened out over the prominent medial epicondyle and much enlarged. It was transplanted to the flexor aspect of the elbow beneath a layer of the deep fascia.

not prevent development of cubitus valgus. No evidence of ulnar palsy. Present.

Fig. 10. Case 10. Separation of epiphysis of external condyle in childhood. 17th growth disturbance resulting in cubitus valgus. There is no involvement of the ulnar nerve as yet.

CASE 6. D. M. male age 20 years. When he was a boy he fell out of bed and broke the right elbow. In 1917 (8 years after the injury) he first noticed wasting of the muscles of the right hand and of late he has observed weakness of the muscles of the inner aspect of the forearm. H.



Fig. 2



Fig. 1



Fig. 3

Fig. 2 Case Fracture of the external condyle in childhood with cubitus valgus, but without ulnar nerve involvement

Fig. 1 Boy aged 4 years Fracture of external humeral condyle such is displaced out, up, and forward. The line of fracture is directed lat rally

Fig. 3 Boy 4 years of age Showing the displacement of the fragments of the fractured external humeral condyle

entered the Presbyterian Hospital January 26 1923, on the service of Dr. Dean Lewis, presenting a typical ulnar nerve palsy except for the lack of sensory disturbances. The X-ray showed an old ununited fracture of the external condyle of the humerus and a marked cubitus valgus. At operation the ulnar nerve was much swollen and flattened out to a diameter of one half inch where it lay stretched out over the prominent medial condyle. The nerve was lifted to the anterior aspect of the elbow and anchored by interrupted sutures to the deep fascia.

CASE 7. A H. female, age 42. At the age of 4 years she fell and fractured the left elbow. After the injury had healed she had no trouble with the arm until about 15 years later when she observed tingling along the ulnar side of the hand and lost two fingers. This has been present off and on ever since, of late being associated with a weakness of the hand, for the relief of which she has received osteopathic treatments without noticeable improvement.

Examination by the author in February, 1923, revealed marked cubitus valgus and a beginning atrophy of the hypothenar, interossei, and adductor pollicis muscles. The X-ray (Fig. 7) shows exactly the same condition as have all the other cases, namely: An old ununited fracture of the external humeral condyle with marked cubitus valgus, and an obliteration of the ulnar groove. At operation, May 8 1923, the ulnar nerve appeared to be pinched between the deep fascia and the floor of the shallow ulnar groove. It was transplanted to the front of the elbow. Five and a half months have elapsed since the operation and we find that the pain is practically gone, atrophy of muscles is less noticeable, and the motor power nearly normal.

CASE 8. T. L. male, age 33. When he was about 4 years old he fell off a kitchen table and fractured the left elbow. The arm was set under anesthesia several times and a cast finally applied. The fracture healed in normal time and he had no trouble whatever with the arm until about 5 years ago when he was husking corn and felt several times tingling sensation along the ring and little fingers. When he was examined by the author in February 1923 a marked cubitus valgus was present and the ulnar nerve could be easily rolled under the finger in a very shallow groove. No signs of nerve paralysis existed. The X-ray (Fig. 8) shows an old ununited fracture of the external humeral condyle with lateral and upward displacement of the atrophied loose fragment. The ulnar groove is very shallow. This case is of particular interest in that the nerve palsy has not as yet put in its appearance. It is difficult to see how it can help but develop in the next few years unless operative interference is instituted.

CASE 9. V. W. female, age 22 years. At the age of 4 years she fell while walking a picket fence and caught the right elbow between the pickets. A cast was applied. When this was removed several weeks later the supination at the elbow was noticed by the mother and for a long time she made the child carry heavy weights to straighten the arm. It never gave her any trouble until about 5 months ago, when she noticed tingling sensations in the ring and little fingers when holding the arm for a long time in the writing position.

She was seen by the author in February 1923 and the marked cubitus valgus was noticed (Fig. 9). The ulnar groove was very shallow but no signs of



Fig. 4. Fracture of external condyle in boy of 6 years. Fragment displaced laterally and fractured surfaces treated out and Reduction by manipulation unsuccessful.

b Reduction by open operation. Alignment good in anterior view but reduction not perfect. Four months after operation. Considerable callus present with imperfect union of fragment.  
d Lateral view 4 months after operation showing the capitulum imperfectly reduced compared with the normal elbow at the same age.

nerve paralysis were present. The X-ray (Fig. 5) shows an old fracture of the external condyle which has united to the shaft. A marked cubitus valgus is present.

It is quite probable that in this case the injury caused a separation of the epiphysis without displacement but the trauma to the cartilage plate was sufficient to interfere with growth enough to produce in later years a cubitus valgus. It is quite probable also that as time goes on the evidence of involvement of the ulnar nerve will become more noticeable. In such an event it would seem advisable to transplant the nerve to the front of the medial condyle.

CASE 4. A. Age 30 years. At the age of 4 years he fell while playing and broke the right arm at the elbow. He has never had any trouble with the arm since that time, but he has noticed that the carrying angle has become more acute than on the normal arm. He plays the piano, great deal and has never been hindered by the deformity. There is no sign of involvement of the ulnar nerve. The X-ray (Fig. 6) made March 2, 1913, shows the old fracture of the external condyle which has become loose, united to the shaft and has produced by its disturbance in growth the cubitus valgus. The ulnar groove is very shallow.

In this case, even though no evidence of nerve involvement exists at the present time

we would expect in later years to find beginning ulnar palsy inasmuch as the nerve has become very superficial as a result of the shallow groove and will undoubtedly become subjected to repeated trauma and stretching.

Since the most common type of injury producing the growth disturbance leading to a cubitus valgus and in later years to an ulnar nerve palsy is a fracture of the external condyle in childhood. It would seem that the attention of surgeons ought to be directed toward a method of treatment of this type of injury which would obviate if possible these serious late results. While it is true that the percentage of late ulnar palsies is very small in proportion to the frequency of external condyle fractures, it is quite probable that the valgus deformity is much more common than we would think and also that if these cases could be traced long enough it would be found that involvement of the ulnar nerve occurs more frequently than the published reports would indicate. At any rate it cannot be denied that the treatment of these injuries deserves serious consideration.

By way of illustration, I cite the following two cases.

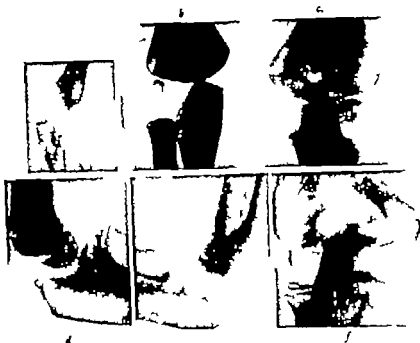


Fig. 5. Roentgenograms of normally developing elbow  
 a, 4 months. No centers of ossification has appeared in the humeral epiphysis  
 b, 3 years. Center of ossification in capitellum present  
 c, 5 years. Centers of ossification in capitellum and internal epicondyle present  
 d, 5 years. Lateral view showing the relation of the capitellum to the sigmoid notch of the ulna and the shaft of the humerus  
 e, 8 years. Lateral view showing the relation of the capitellum, trochlea, shadow and medial epicondyle to the humeral shaft  
 f, 8 years. Anterior view showing the three centers of ossification of the epiphysis, capitellum, trochlea, and medial epicondyle

J. V. age 4 years, came to the Central Free Dispensary November 21, 1922 with a history of having fallen out of bed 4 weeks previously and broken the right elbow. It was put up in splints by the neighboring doctor but the progress had not been satisfactory. On examination there was found a prominence on the lateral aspect of the elbow and crepitus on motion, which was limited both in flexion and extension. The X rays (Figs. 12 and 13) made January 27, 1923 3 months after injury, show a fracture of the external condyle of the humerus which is split in two pieces, both displaced laterally and upward, and the larger one forward. Their fractured surfaces are directed upward and laterally. It is quite obvious that under such circumstances there is not even a possibility that union of the fragments with the shaft can occur and if that is true there is bound to be growth disturbance on the lateral side of the humerus which will lead to a cubitus valgus, and in later years perhaps to an ulnar palsy.

factors producing growth disturbance at the epiphyseal line are injury to the cartilaginous plate of the epiphysis and interference with its blood supply both of which are present in this case. It seems to us that instead of being content to put this child's elbow up in the flexed position according to the accepted rule it would have been better to operate at once and make as accurate a reduction of the fragments as possible with the hope that growth disturbance would be minimized if not wholly prevented.

It was with this idea in mind that the following case came to operation.

J. C. age 6 years, entered the dispensary September 8, 1922 with the history of having fallen from a fence and injured the right elbow. Examination showed marked swelling and ecchymosis about the elbow and acute tenderness on the lateral side where a bony prominence was felt. The X ray (Fig. 14, a) showed a fracture of the external con-

Heas (4) of San Francisco has shown experimentally and it has recently been emphasized by Speed (16) that the two main



dyle of the humerus which was displaced laterally and rotated so that the fractured surface was directed out and II was admitted to the Presbyterian Hospital and came to operation October 6.

Through a lateral incision the supinator longus was retracted forward exposing the loose condyle with its articular surface in contact with the fractured surface of the shaft. With some little difficulty it was replaced and held in position by closure of the fascia. A molded splint was applied in the right angle position. The X ray (Fig 14, b) made a few days later showed good alignment in the anterior view and it was thought that a very good reduction had been made. Four months later however when another picture was made (Fig 4, c and d) it was found that even though considerable callus had been formed, there was not solid union and the fractured condyle was still displaced upward and forward from its normal position. This will be readily seen in comparison of Figure 14, d and Figure 6 d, which is lateral view of the normal elbow of a boy about the same age. It has been recently shown by Cohn ( ) of New Orleans, that at this age

the distal humerus lies longitudinally through the middle of the humeral shaft, all just touch the posterior edge of the external condyle, so that in our case there is fully 6 millimeters, anterior displacement of the loose fragment. This is without doubt sufficient displacement seriously to interfere with the growth of the lateral half of the humerus. If we had fixed this loose fragment accurately in contact with the shaft with a small nail for a time it probably would have been much better. It will be of interest to follow both of these cases in later years to see whether a cubitus valgus develops.

#### CONCLUSION

Fractures of the external condyle of the humerus, which occur most often in child-

hood should be operated on if the loose fragment cannot be accurately reduced by manipulation because the growth disturbance following non-union is very likely to result in a marked valgus deformity which may in later years produce a paralysis of the ulnar nerve. If this occurs it is the duty of the surgeon to relieve the tension on the ulnar nerve as soon as the first signs of paralysis appear either by a correction of the deformity as recommended by Mouchet, or by transplantation of the nerve to the flexor surface of the elbow.

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## PRIMARY CARCINOMA OF THE URETER

WITH A REPORT OF A CASE AND A REVIEW OF THE LITERATURE<sup>1</sup>

By HERMAN L. KRETSCHMER, M.D. F.A.C.S. CHICAGO

OF the malignant tumors occurring in the ureter carcinomata are more common than sarcomata. Carcinoma occurring in the ureter may be primary or secondary. Secondary carcinoma may originate in the kidney pelvis by direct extension or the ureter may be involved by a carcinoma of the bladder. The ureter may also be involved secondary to a carcinoma of the uterus or the ovary.

In a recent article Aschner was able to collect 47 cases of primary tumors of the ureter including both benign and malignant cases. It would thus appear that primary epithelial tumors in the ureter are rare.

This paper will be limited to a consideration of primary carcinoma of the ureter. From the available literature I have been able to collect 34 cases to which I wish to add a case under recent observation thus bringing the total number of cases for discussion up to 35. The history of the case under recent observation follows:

G. M., age 74, referred by Dr. Charles Colleser. Ten years ago patient was operated upon for carcinoma of the lip. Complete cure. Patient was well until five weeks before he came under observation when he began to pass dark red urine. Since the onset of the trouble the urine was never entirely free of blood. The amount of the bleeding varied so that at times the urine was either very dark red or light red. Blood and urine were well mixed occasionally clots were passed. Nocturia has been present for several years. During the last 2 months he has lost about 10 pounds in weight.

General physical examination was negative. The scar from the previous operation for carcinoma of the lip was normal. No local recurrence. Kidneys, ureters and bladder negative. Rectal examination showed a slight enlargement of both lateral lobes of the prostate.

Cystoscopic examination showed a definite trabeculation of the kidney and at the vesical neck a large median bar. The ureteral orifices were normal. No signs of tumor in the bladder or in or around the ureteral orifices were present. The ureters were catheterized without difficulty or obstruction.

A pyelogram was made and on the right side the catheter took a most unusual course. It appeared

and outward in an S-shaped curve the tip overlying the midpoint of the crest of the ilium. At the level of the second lumbar a dense rounded shadow was seen, the size of a half dollar. There was marked hipping of the lumbar spine and thickening of the sacro iliac joint. No stone shadows were seen (Fig. 1).

Cell count and cultures were as follows:

	Leucocytes per cubic millimeter	Culture	Tuberculous
Bladder	3	Sterile	Negative
Right kidney	190	Sterile	Negative
Left kidney	50	Sterile	Negative

Operation, September 3, 1922. The patient left the city and returned to his home where he was operated upon by Dr. Phenaster to whom I am indebted for his kindness in turning over the specimen to me for study. The usual blique lumbar incision was made over the right side and a lumbar nephroureterectomy was performed. The patient made an uneventful recovery.

## SEX

According to the cases reported the incidence of sex seemed to play little, if any rôle. Males were more frequently affected than females, but the difference was so slight as to be negligible. The number of males including the case here reported is 19 females 16.

## AGE

Here, as in other forms of malignant disease of the urinary tract, it may be stated that carcinoma occurred with greater frequency in advanced years although there were exceptions to this statement. The exceptions were the cases of Albarran, 36 years. Finsterer 35 years. Zaroni 36 years. Aschner 38 years. There were two patients aged 80, one reported by Richter, the other by Tourpet and Gueblat. Curiously enough both these patients were females. The following table shows the incidence of age:

Age	No. of cases
30 to 39	4
40 to 49	7
50 to 59	9
60 to 69	9
70 to 79	8
80 to 89	1
Age not stated	



Fig. Roentgenogram showing the course of the ureter and the incompletely filled kidney pelvis.

#### PRESENCE OF CALCULI

Although it has repeatedly been stated that the presence of stone may be an etiological factor in causing carcinoma and in order to support this statement attention has been called to the frequency with which stones and carcinoma of the gall bladder are found at the same time, it would seem that in the urinary tract, stones and carcinoma do not occur simultaneously as often as in the biliary tract. Evidently stone is of no moment as an etiological factor in causing carcinoma of the ureter since only in 5 cases was it present. Its occurrence in the ureter has been mentioned by Davy, Metcalf and Safford, Paschke and Zaroni. In Judd and Struthers' case the patient stated that he passed a stone. In the St. Thomas Hospital case stone was present in the opposite kidney and in Aschner's case it was found in the kidney on the corresponding side.

#### PATHOLOGY

*Type of tumor.* From a review of these 35 cases it appears that the papillary form of carcinoma occurs most frequently in the ureter since 8 of the 35 cases were of this

type. Next in point of frequency were the medullary carcinomata, 5 cases, and the squamous celled carcinomata, 5 cases. In one case the tumor was described simply as an epithelioma. No further histological description was noted. Epithelial carcinoma was the term used to describe 3 cases. In 2 cases the tumor was described as transitional celled carcinoma. In 1 case the term carcinoma solidum simplex was used and in another case, simply carcinoma.

Since squamous cells are not normally present in the renal pelvis the presence of squamous celled carcinoma brings up for discussion the interesting question of metaplasia, the occurrence of which has been previously discussed.

	No. of cases
Papillary carcinoma	8
Squamous-celled carcinoma	5
Medullary carcinoma	5
Epithelial carcinoma	3
Transitional-celled carcinoma	
Epithelioma	
Carcinoma solidum simplex	
Carcinoma	

One of the most constant concomitant pathological findings is hydronephrosis. This is but a natural development as it is the direct result of the tumor producing a stricture or obstruction within the ureter with a resulting hydronephrosis above the obstruction. Hydronephrosis has been recorded as present in 26 of the 35 cases. In 9 cases neither the presence nor absence of hydronephrosis was noted. It is possible that the real incidence of hydronephrosis is larger than appears from a review of the literature since some of the authors may have neglected to report its presence. In the case reported in this paper a small hydronephrosis was found above the tumor. This was demonstrated by the pyelogram before operation.

#### METASTASES

It would appear that metastases occur in these cases as frequently as in any other form of carcinoma. In 3 cases bone metastases were stated to be present: lumbar vertebra (Adler), ilium (Helkoten), spine (Schmitt). The following distribution has been reported:

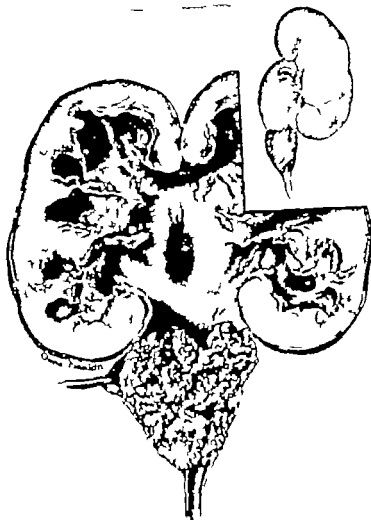


Fig. Papillary carcinoma of the ureter with hydronephrosis

Liver and lymph glands  
Right lung and bladder  
Liver, lungs and lymph glands  
Liver, left kidney and spine  
Liver, lung and lymph glands ( )  
Right kidney  
Nerves

Davy  
Gerstein  
Randle  
Schemm  
Voelcker and Vorpahl  
Israel  
Kidd

portion of the ureter since in 19 cases it was found at varying parts in the lower third. In 2 cases it was stated that the tumor was situated in the middle of the ureter and in the remaining 8 cases the upper ureter was involved. The entire ureter or practically the entire ureter was involved in 6 cases.

#### SYMPTOMS

Hematuria heads the list of symptoms because it is the most constant symptom having been present in 24 of the 35 cases. In some of the remaining cases no mention is made of bloody urine. This probably does

It is interesting to note that in 5 of the 8 cases there were metastases in the liver which appears to be more frequently the seat of metastases than any other organ.

#### LOCATION IN THE URETER

A study of these 35 cases shows that carcinoma occurs more frequently in the lower

not represent accurately the exact status regarding the occurrence of haematuria. In view of the fact that some of the cases, being autopsy cases, received only brief mention. In several cases definite statements were made that blood in the urine was absent (Adler Von Capellen, Hektoen, Toupet and Gruenlot, Wising and Blitt). Pain was a most important and constant symptom being present in 26 of the 35 cases. There was nothing characteristic about this pain from which a diagnosis of carcinoma of the ureter could be made or surmised, nor was it always referred to the same place. In 21 cases pain was the first symptom noted and was most frequently referred to the back on the corresponding side on which the tumor was found. The most frequent terms used by the authors in describing the location of the pain were lumbar region, region of the kidney in the back, and in the abdomen. In 5 cases the pain was referred to the hip (Hektoen, Gerstein, Spess, St Thomas Hospital and Kidd). In some of the cases the pain was due no doubt to the hydronephrosis.

#### DIAGNOSIS

The diagnosis from the history and physical examination is almost impossible especially when the tumor is small but when it reaches a large size so that it can be felt by abdominal palpation the diagnosis can be made or surmised. In women it is possible to palpate the tumor through the vagina and in men carcinoma of the lower ureter may be felt through the rectum. In order to make an accurate diagnosis, it will be necessary to resort to the use of special diagnostic aids such as cystoscopy, ureteral catheterization, and pyelography. In cases in which the tumor protrudes from the ureteral orifice the diagnosis can be made by the cystoscope or a diagnosis may be ventured when there is profuse hemorrhage from the ureter associated with obstruction, as demonstrated with the ureteral catheter assuming, of course, that stone and stricture have been excluded. But we must not forget that both stone and carcinoma may occur at the same time. Persistent bleeding from the ureter after nephrectomy is highly suggestive of ureteral neo-

plasm. In a recent letter from Dr. Colletter he informed me that the patient whose case is here reported has again passed blood in the urine. This probably means that the patient has recurrence of tumor formation in the stump of the ureter.

In view of the fact that hydronephrosis is so frequently found pyelograms may give some additional information. The present literature contains nothing in the way of pyelographic data since most of the cases were published before pyelograms became part of our routine examination.

A pre-operative diagnosis of carcinoma or tumor of the ureter was made by Albarran, Chevasse and Mock, Gerstein, Judd and Struthers, Kathman, Richter and Zimol. The following is a list of some of the pre-operative diagnoses made: sarcoma of the ilium (Butler), pyonephrosis (von Capellen), bladder papilloma (Minister), ureter calculus (Metcall and Safford), carcinoma of kidney (Rundle), rheumatism and dementia praecox (Spess), papilloma of the kidney with secondary involvement of ureter (Kidd).

A diagnosis of tumor of the kidney with hydronephrosis was made in the case reported here. This was based upon the age of the patient, slight loss of weight, a persistent painless unilateral renal haematuria, the pyelogram and the fact that pure blood was obtained from the ureteral catheter at the end of catheterization.

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## SOME RARE ANOMALIES OF THE KIDNEY AND URETER WITH CASE REPORTS

B ROBERT V DAY M D F A C S LOS ANGELES, CALIFORNIA

**A**NOMALIES of the kidney and ureter of one kind or another are of rather frequent occurrence. The most common types are unilateral duplication—partial or complete—horseshoe kidney and ectopic kidney on one side. Therefore, only extremely rare congenital defects are herein reported and cases of the above mentioned fairly common types are purposely omitted with one exception, namely a unilateral bifurcated ureter with a mechanically perverse filling defect, Case 5. Of the 11 cases, 10 are congenital defects and 1 (Case 6) acquired. The first 6 described are all alive and in the remaining 5 the anomaly was discovered at necropsy.

**CASE 1.** A 42 year veteran, under care of Public Health Service, Veterans Bureau at Los Angeles (Hosp No 553756). Patient's chief complaint is bronchial asthma of 7 years duration. Temperature range, 97.4 to 99.3 degrees. He has ycturia which is worse at times, and the frequent getting up at night aggravates his asthma. Urinalysis discloses some pus. He was referred to Dr Joe Zeiler for urologic study. He has slight stricture in bulb.

Cystoscopy discloses only one ureteral meatus, and this is situated at the normal site on the right. This was catheterized and pyelo ureterograms made. The ureter shadow ascends in a curve to the sacro-iliac junction and crosses to the left, with the only crossing to the right just as if the kidney had been normally placed on the right instead of on the left just above the iliac crest (Fig 1). Patient was referred to me by Doctor Zeiler to check the findings and for decision as to treatment. Cystoscopic examination verified Doctor Zeiler's findings of only

one ureter. His urethra was explored with a McCarthy instrument. No ureteral orifice was found in the posterior urethra. A No 10 flexible tip catheter was passed with this instrument through the ureter into the kidney pelvis. Indigocarmine injected intravenously appeared through the ureter catheter promptly and no dye escaped around the catheter into the bladder.

The McCarthy cysto urethroscope was left in and constant observation made for dye coming from a concealed ureter opening, both in the bladder and posterior urethra, for a 25 minute period. Not the slightest dye appeared except through the ureteral catheter. A pyelo-ureterogram was made with the catheter in the kidney pelvis and another by injecting with considerable force and withdrawing the catheter simultaneously until its tip was in the extreme lower ureter. No bifurcation was observed. Patient has a slight hernia on the left side and an ectopic testis in the left inguinal canal. His twin brother died at 3 years of age, cause of death unknown to him.

Horand (1) reported a case of this kind and according to Garceau (2) the only one in the literature.

**CASE 2.** K M age 31, student, entered Los Angeles County Hospital, January 5, 1922 (Hosp No 163131). Patient slipped from the running board of an automobile about 1 month ago, and suffered severe lumbar pain a few hours afterward. His urine contained blood, but no pus at first. A few days later he had definite pyuria. Cystoscopy disclosed no left ureter opening in the bladder. There was an oval opening in left side of urethra near the colliculus. Catheterized specimen from this side was creamy with pus. Uretero-pyelogram (Fig 2) showed immense dilatation and accumulation of both the ureter and kidney. Patient was moderately ill, but not bedridden. He denies gonorrhea.

no previous history of urinary disease or urinary symptoms, dribbling or incontinence. Mother had barep. History otherwise irrelevant.

January 4, 1921, nephro-ureterectomy. An infected by dronophrotic sac and hydro-ureter holding 350 cubic centimeters were found. The terminal portion of ureter as too fibrous, rigid and adherent to be removed. Convalescence was uneventful.

March 1921 glass test first glass quite clear, second glass markedly purulent. The stump of ureter was catheterized the fluid drained off, injected with sodium bromide, and picture taken (Fig. 3). Repeated the procedure of catheterizing, lavaging, and draining on 3 subsequent occasions, but sac refilled with urine each time and sinuses in the middle of each incision above gave no evidence of healing.

March 3, 1921 readmitted to the hospital. Young perineal exposure made after previous incision of ureteral catheter into the stump through cysto-urethroscope. It was impossible to remove the sac, but it was opened accidentally. The terminal portion of the ureter coursing through the base of the left lobe of the prostate was not dilated and was dissected out, ligature thrown around it the catheter withdrawn ligated near the urethra, and cut off. The sac was drained by cigarette drain. All wounds healed speedily and the patient left the hospital in 17 days. He has been in good health since.

A careful search of American and foreign literature reveals 20 cases of ectopic opening of the ureter in the male posterior urethra and 1 in the male genital tract. Twenty-nine were discovered at necropsy. The cases of Chute (3) and Albarran (4) were discovered in the course of operation.

Cases of solitary dysplastic kidney situated in the true pelvis are extremely rare. Cullen (5) reports a case. Judd and Harrington (6) in an article on ectopic kidney in reporting 17 cases of ectopic or pelvic kidney, report a single case of this character the only one observed at the Mayo Clinic up to that time. Polk (5) of New York, operated on a case of this character in 1882. The mass in the pelvis was removed and it proved to be a right pelvic kidney. The patient lived 13 days and at autopsy Welch found this to be the only kidney. Strube (7) reports a case.

Male infant. Aged 4 weeks. No left kidney or ureter. Right kidney low down in true pelvis entirely filling its cavity. It was of irregular shape adapted to the concavity of the sacrum. Single ureter on right side of

bladder. 3 renal arteries. No other case reports could be found in the literature available.

CASE 3. Miss J. R. age 20 Mexican, entered Los Angeles County Hospital July 29, 1921 (Hosp. N. 68076). Patient complained of pain in the right iliac region, which lasts from 4 to 7 days once a month. She has never menstruated. She has headache of severe type, coincident with pelvic pain. Otherwise she has never been ill. Pain began when she was 5 years old. She has been married 4 years. Pain has been more severe since she has been married.

Physical examination and examination of external genitalia are negative. Bimanual examination reveals no apparent absence of the uterus and ovaries. She has right inguinal hernia. Secondary sexual characteristics are well marked. The vagina is short, length 7 centimeters, and ends in a vault with cervix. Dyspareunia is very slight. She was advised to have operation for relief of pain in right lower quadrant. It was explained to her that it would not alter her amenorrhea. The boy notes were made by Dr. Phil Boeller who operated on her August 1921 and who has kindly furnished the operative data as follows: Operation (1) nephrotomy (2) appendectomy (3) right inguinal herniotomy. The abdomen was opened by median suprapubic laparotomy incision. A rudimentary tube was found on the right side its origin lost in the peritoneum on the lateral pelvic wall. Located in the center of the pelvic cavity was a mass which resembled, very markedly a slightly enlarged and congested uterus except that the peritoneal covering was rather loose. A incision was made into the cavity of the supposed uterus and then it became evident that the mass was kidney with the hilus located posteriorly. The nephrotomy incision was closed and exploration made of the upper belly. No other kidney existed. There may have been present in some of the peritoneal folds of the pelvis, some rudimentary structure which may have been an ovary. This could not be determined with accuracy. The operative work was completed without drainage. The patient made an uneventful recovery. Following convalescence patient referred by Doctor Boeller to Urological Department for check.

August 30, 1921. Cystoscopy disclosed one ureter opening on the left side near the midline of the bladder. Cysto-urethroscopy disclosed no opening in the urethra or bladder. There was no clinical history of incontinence or dribbling. Intravenous injection of indigo-carmin was followed by no dye excreted slight leakage around the catheter in the ureteral meatus which could be plainly seen. Pyelo-ureterogram (Fig. 4) was made of this kidney. The marginal outline is necessarily not distinct by reason of the shadow being directly over and blending with bone tissue namely the sacrum, coccyx, and ilium at the sacro-iliac joint.

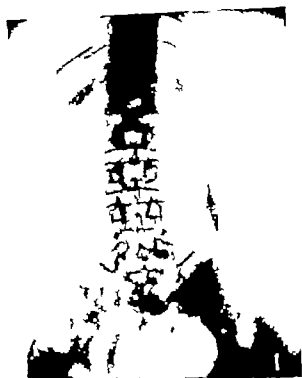


Fig. 1 Longitudinal single kidney with crossed ureter

Fig. 2 Infected hydronephrosis and hydro-ureter with ureter sprouting at posterior urethra. Case

Fig. 3 Closed sac formed by stump of ureter after nephro-ureterectomy. Case

Fig. 4 Single dysplastic kidney, outline of single ureter good, of kidney pelvis obscured by body. Case 3





Fig 5



Fig 6



Fig 7

Fig 5 Complete bilateral duplication. Case 4.

Fig 6 Bifurcation left ureter opposite fourth lumbar catheter enters upper pelvis. find irrigates into lower pelvis leaving upper empty. Case 5.

Fig 7 Pocketed multiple bird-seed calculi resembles large calculus, pressure necrosis and separation of ureter from kidney pelvis. Case 6.

CASE 4. Mrs R. N., age 7, minister's wife, referred by Dr. George Thomson. Patient consulted me July 7, 1920. She has one child 8 months old. While pregnant, routine examination showed pus and albumin in urine repeatedly. Considerable frequency from fifth month of pregnancy to present time. Present complaint: frequency of urination. Urine contains microscopic pus and Gram negative bacilli; also trace of albumin. Cystoscopy disclosed ureter openings on each side at about the normal sites. All 4 ureters catheterized simultaneously at second visit after previous combined phenolsulphone phthalein and blood chemistry. Phenolsulphone phthalein from right ureters 7 and 6 per cent respectively; left 9 and 6 per cent respectively. Microscopic pus from both catheters on the right none from either left ureter. Multiple pyelograms made (Fig. 5) show complete bilateral duplication. Pus and albumin in the bladder urine and frequency of urination disappeared very soon after ureteral catheterization.

Merta (8), Harpster (9) and Brausch (10) have each reviewed the literature very admirably. Approximately 86 cases of bilateral duplication—partial or complete—have been recorded in the literature, combining clinical and autopsy cases. Nine of these have been discovered at the Mayo Clinic, 8 complete and 1 partial. Of these 86 cases 48 were complete bilateral duplications of the ureter with 11 more cases of complete bilateral du-

plication with one ureter ending blindly or having an ectopic orifice.

No doubt these anomalies often predispose to infection for mechanical reasons affecting drainage. In the author's case the symptoms were mild and the patient had never consulted a physician regarding any urinary disturbances. History and urinalysis preceding a proposed tonsillectomy caused her to be referred for urological investigation.

CASE 5. D. M., age 33, referred by Dr. E. C. Moore April 26, 1920. Patient developed urethral discharge while in overseas service 3 years ago. Mild character but rather profuse from onset. Had been continuously in government hospitals France and in Arizona and California for months. He gave history of some pain in left flank 4 times; had never been cysto-scoped. Urethral smear showed no gonococci. T. glass test both glasses creamy. N. residual urine. Prostatic juice after massage 90 per cent pus. C. thetized specimen reaction acid and trace of albumin; pus and Gram negative bacilli.

April 7, 1920, catheterized both ureters easily. Pus and bacilli came from left; occasional bacillus but no pus from right. Pyelograms were made (Fig. 6). In this picture the ureter catheter on the left side seems to have punctured the ureter on its medial aspect opposite the fourth lumbar vertebra. I knew this could not be, since urine free from gross blood dropped from this catheter and there had been

excreted 2 per cent of phenolsulphonephthalein in 20 minutes from that side.

Patient sent to California Lutheran Hospital (Hosp No 59477) for rest and treatment.

May 1930, left ureter catheterized with No. 11 Garceau and pyelo-ureterogram taken. Picture showed bifurcation of left ureter opposite fourth lumbar vertebra with upper and lower pelvis well injected. The bizarre feature was that the catheter well placed within the upper pelvis, failed to inject it but did inject the lower pelvis and its ureter as far down as the bifurcation. The urethral discharge diminished very markedly after the first urethral catheterization, but there was very little further improvement despite the usual treatment plus repeated kidney lavage and ureteral dilatation up to the time, a few weeks later when he re-entered a government hospital.

CASE 6 Miss B. H. age 34, referred by Drs Roland Cummings and F. M. Pottenger March 1931.

Patient had had mild pulmonary tuberculosis 8 years ago, with no activity of disease for years. She gives a history of mild obscure abdominal disorder for past 3 or 4 years. During this time she complained of bloating, gas, and slight mucous stools. She had no pain or fever until one week ago. The pain started in the back, but after few hours manifested itself entirely in the front. Examination at that time by Doctor Cummings showed a mass in the left kidney region, fluctuant, and only slightly tender. Temperature 103 degrees. Swelling gradually subsided and 6 days after onset of attack no mass could be palpated. Temperature now 98.8 degrees. Urine shows faint trace of albumin, small sediment, few pus cells, many short chain streptococci and some staphylococci. Cystoscopy showed urine from right kidney negative left—no drip. No phenolsulphonephthalein, no leakage of phenolsulphonephthalein into the bladder.

The ureter was injected for pyelogram (Fig. 7) but failed to ascend above the fifth lumbar vertebra. This was repeated later and stereopyeloureterograms showed the upper end of the ureter curving abruptly forward as though the end was distinctly against or near the parietal peritoneum of the abdominal wall.

There seemed to be a closed hydronephrosis with multiple calculi. It did not seem possible, however, that a kidney with calculi over such an area as shown in the picture, extending from above the twelfth rib to one inch below the crest of the ilium, could escape palpation. Stereocystenterograms following barium enema showed the shadows behind the barium. Indigo-carmine injected intravenously did not appear in the vagina, vestibule or colon flushings. The possibility of a left ureter with congenital absence of the left kidney was considered. This must be extremely rare, but does occur (vide Case 10 in this report).

On March 3, 1931, left nephrectomy was performed at California Lutheran Hospital (Hosp No 63559). An elongated sac containing about 300

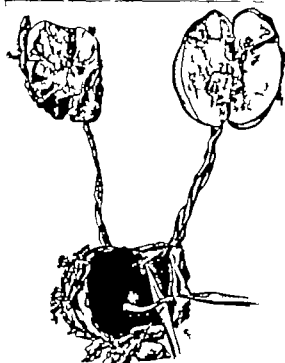


Fig. 8 Congenital loop apparently making the ureters continuous. Lumen on left to mid line of bladder. Case 7.

cubic centimeters of fluid, but not dense, antero-internal to a long flattened kidney shaped like a calf's tongue, was easily removed with the kidney. It had a long pedicle, no adhesions and no forceful finger dissection was necessary. The renal vessels came off extremely high and quite a way from the lower pelvo-ureteral junction. Notwithstanding this, the ureter was never encountered or seen during the operation. Specimen examined by Dr. A. H. Zeiler with following report:

Kidney is elongated to 4.5 centimeters in length. The hilum is hollowed out and occupied by a greatly dilated pelvis. This is triangular each side of the triangle measuring 9 centimeters after fixation. The ureter is not present—there is a tiny opening at the apex of the triangle which may represent the opening into the ureter. Sections show that the kidney substance is thinned out—usually less than 1 centimeter thick. The pelvis contains a great mass of tiny calculi which are brown, usually oval, averaging 3 by 1.5 millimeters. The mucosa of the pelvis is granular.

The X-ray shadows were caused by an enormous number of tiny calculi, exactly resembling birdseed in size, shape, and color. One thousand of them weighed 6.54 grams. There must have been 10,000 of them altogether as will be readily imagined from their small size and the enormous shadows seen in

the illustration. Chemically they consisted of calcium and magnesium carbonates and pigment.

Patient relieved in due time of her former symptoms, gained 20 pounds in weight, and feels entirely well at the present time.

A possible explanation of the mechanical factor in this case is this: stenosis of the pelvo ureteral junction back-pressure hydronephrosis, sudden complete obstruction, great distention of the renal pelvis therefrom, distortion and angulation at pelvo ureteral junction as suggested by stereoscopic ureterogram and the distended kidney pelvis appearing more or less anterior and ahead of the kidney as delivered through the wound and as a final result pressure necrosis at the angulated point with separation and retraction of the ureter downward toward the bladder.

**CASE 7.** P. W., age 36, consulted me in the office, January 5, 1913. Patient complained of frequent urination, gas in stomach, loss of weight and appetite, and swelling of the left testicle. First consulted physician 5 years ago for hematuria. Since then he has been gradually getting worse. The frequent intermissions of improvement. The urine is very cloudy. Residual urine 380 cubic centimeters. T removed this required frequent suction of syringe by reason of its thick, tenacious, mucous character. A diverticulum was suspected and cystogram made—negative for diverticula. Numerous tubercle bacilli were found in the urine. Blood chemistry: non-protein nitrogen 50 milligrams creatinin 3.7 milligrams. He was referred to Los Angeles County Hospital (Hosp. N. 8422) with request that he be treated as a prostatic and drained by catheter for requisite period before any cystoscopic procedure. Died January 9, 1913. Abstract from necropsy findings:

In addition to bilateral pulmonary tuberculosis, tuberculosis of the bladder and ascending colon and urinary tuberculosis of the bladder there was complete destruction of the right kidney—tuberculosis—with occlusion of the right ureter over a distance of several centimeters—auto-nephrectomy on the right side. There was advanced tuberculosis of the left kidney with dilated tuberculous ureter.

The left ureter did not terminate in meatus as it pierced the bladder, all but extended directly through the bladder wall made a loop across the trigone and became adherent through thick, fibrous cord to the right of the trigone extending to the internal lip of the right ureteral meatus (Fig. 8). There was meatus on the external surface of this tube about centimeter from the point where it (the left ureter) pierced the bladder (Fig. 8). The pathologist states one could easily insert finger under this loop before it was severed. The

lumen of this tube extended fully to the midline of the bladder and gave the appearance of having been patent all the way across to the right and continuous with the right ureter but obliterated by the tuberculous process, just as the middle portion of the right ureter had been obliterated. A similar case in the literature available could not be discovered.

Congenital single kidney normally placed with normal ureter is considerably more rare than horseshoe or fused kidney. Ballowitz (11) reviewed 213 cases of congenital absence of one kidney from the literature. The corresponding ureteric orifice was absent in all but 15. When a ureter is present on the side where the kidney is absent, it is usually short and rudimentary and very rarely occurs. Absence of one kidney is often accompanied by some malformation in the genitals.

**CASE 8.** W. B., age 66, died of uremic complications of myeloma, and believed he has prostatism. T. glass test: glass 1 clear, glass 2 contains trace of blood but no pus. Residual urine 1 ounce. The prostate is quite large by rectal palpation and cystoscopy. The bladder is trabeculated. Both ureteral meati open normal. He presented large symptoms, but easily palpable right kidney and no blood in his urine. I suspected neoplasm. I catheterized right ureter easily, but every size and shape of catheter would enter left side only about 4 millimeters. It was thought catheter could be passed later date, as often happens. Since he had perfect meatus on this side, absence of one kidney was not considered. Functional test as not done inasmuch as only one side could be catheterized at that time. A pyelogram on the right side was made, however, to discover if the large kidney was neoplastic. The pyelogram was normal. Seven weeks later he contracted influenza, was sent to the Los Angeles County Hospital, and died there from broncho-pneumonia, December 29, 1919 (Hosp. No. 4449).

Necropsy disclosed complete absence of the left kidney and ureter with a very large infected, but otherwise normal, right kidney normally placed.

**CASE 9.** A. A., age 30, admitted to Los Angeles County Hospital October 9, 1919 (Hosp. N. 3943). On medical side until his death, November 9, 1919.

Clinical findings of organic spinal cord disease. His urinary infection as attributed to cord lesion and urologists not consulted.

Necropsy findings: pulmonary tuberculosis, tumor of spinal cord opposite the eighth dorsal vertebra, small tumor (nodular) in right adrenal, tuberculosis of right kidney and bladder, congenital absence of the left kidney and ureter, and no ureteral meatus present in the bladder on the left side.

**CASE 10.** (Personal communication from Dr. Glanville Rusk, Professor of Pathology, University

of California) Male age 34, died March 6 1922  
 Uræmic symptoms appeared one week after contract-  
 ing influenza Necropsy findings (A/23/22 of series)  
 right kidney apparently absent small well developed  
 normally patent ureter on this side extending from  
 the bladder to the right renal fossa where it ended  
 abruptly in a thin solid fibrous cord This condi-  
 tion was later verified by a roentgenograph taken  
 after injecting the ureter with opaque substance  
 (sodium bromide) In this it was seen that the in-  
 jected material ended sharply at the kidney region,  
 about showing the least trace of a renal pelvis  
 Subsequent sections from the right ureter showed  
 a fully patent tubular structure with a three-  
 layered wall identified microscopically as ureter  
 The tissues about the right renal fossa, together with  
 the right ureter, were removed *en bloc* and multiple  
 sections taken serially from the region included be-  
 tween the distal closed end of the right ureter and  
 the right renal Microscopic examination of these  
 sections showed fibrous and fatty tissue striated  
 muscle, nerve and ganglia, but no sign of renal  
 tissue Investigation of the large blood vessels  
 disclosed a normal renal artery on the left, but only  
 a small blind outpocketing from the aorta in the  
 region of the renal artery on the right

CASE 1 E. B. male age 7 admitted to Los  
 Angeles County Hospital, April 30, 1913 (Hosp No  
 180306) Child was well until months ago at  
 which time he developed a non-productive cough,  
 pain in chest, nausea and vomiting, swelling of  
 ankles, and difficulty in breathing Death occurred  
 the day following admission to the hospital

Necropsy findings: 1. Congenital absence of right  
 kidney and right renal

2. Left kidney had 2 separate pelves, each with  
 separate ureter The ureters run parallel to each  
 other as far down as the fifth lumbar vertebra,  
 here the one draining the cephalic pelvis turns  
 obliquely to right and enters the bladder at the nor-  
 mal position on right and ureter draining caudal  
 pelvis enters bladder at normal position on left

3. Examination of the single kidney disclosed  
 diffuse subacute nephritis Marked hypertrophy  
 of heart but no valvular lesion ascites, hydro-  
 thorax and hydropneumothorax were present

Here then we have congenital absence of  
 one kidney in 4 individuals of 4 distinct types  
 namely

Case 8 normal ureteral meatus but no  
 ureter on side with no kidney

Case 9 no ureter or ureteral meatus on  
 anomalous side

Case 10 ureter extending to near normal  
 kidney position, but no kidney tissue in or  
 around this area nor any evidence of renal  
 vessels

Case 11 single kidney normally placed with  
 complete duplication of pelvis and ureter in  
 which cystoscopically the right and left  
 ureteral meati would appear normally placed  
 in the bladder

With Cases 1 and 3 added we have 6 dis-  
 tinct types of congenital solitary kidney

The obvious lesson from the clinical study  
 of individuals with congenital defects of the  
 urinary tract is to take advantage of every  
 accessory method of examination and in-  
 vestigation when the routine standard pro-  
 cedures leave certain findings otherwise un-  
 accounted for

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OSTEOCHONDRITIS DEFORMANS JUVENALIS<sup>1</sup>

By A. H. DALY, M.D., F.A.C.S., ANAHEIM, CALIFORNIA

Jonathan W. Foster, Clerk

LEGG (15) in 1910 under the title "An Obscure Affection of the Hip-Joint" called the attention of the profession to a condition in the hip which had theretofore been diagnosed as tuberculosis, but which he believed to be a separate disease entity. He described the symptoms and roentgen-ray findings of the condition, which has since been designated as osteochondritis deformans juvenalis, but offered no theory as to its etiology except that trauma, direct or indirect might be a factor. He summarized his findings in a general way as follows:

- 1 Age five to eight years
- 2 History of injury
- 3 Limp
- 4 Thickening about the neck of the femur
- 5 Absence of pain
- 6 Absence of constitutional symptoms
- 7 Little or no spasm
- 8 Absence of shortening—

and causative queries as follows:

- 1 Is this condition the result of congenital deformity or faulty development?
- 2 Is it the result of a constitutional disease?
- 3 Is it the result of direct injury?
- 4 Is it indirectly due to injury?

The writer has reviewed the literature on the subject with the hope that an answer might be found to one of the above questions or that one of the various etiological theories so far advanced might be established on a firmer foundation.

## REVIEW OF THE LITERATURE

The older books on diseases of the joints bear evidence that osteochondritis deformans juvenalis existed in the past. Brodie (4) in 1842 in writing of tuberculosis of the joints, said that if it received very early attention the function of the joint might be wholly unimpaired. The cases on which he based this statement undoubtedly were of osteochondritis deformans, since it is known that tuberculosis

of the joint always causes some permanent destruction of the joint. Had the condition of osteochondritis deformans juvenalis been recognized earlier fewer cases would have been reported as cured of tuberculous coxitis, with return of normal function by certain methods of treatment or by a special form of brace.

Shortly after the publication of Legg's original article there appeared a paper by Perthes (18) in which he presented clinical and roentgenological findings identical with those described by Legg, but Perthes, at that time considered the condition to be a deforming arthritis of the juvenile type.

In 1913 a second article by Perthes (19) was published in which he gave to the condition the name of osteochondritis deformans juvenalis and refuted his original idea that it was a form of juvenile arthritis. He gave a detail of the symptoms of the disease similar to Legg's in 1910. He could not agree that the condition was in any way related to arthritis or tuberculosis. He observed in his cases that in spite of improvement in mobility in the joint, roentgen-ray examinations showed steady increase in the size of the femoral head ending in the mushroom deformity observed by all writers. In the one instance in which he operated he described the macroscopical and microscopical findings in detail, and asserted that no evidence of infection was found. The entire picture did not in any way coincide with the changes found in arthritis deformans, and he concluded that the two diseases were in no way related. He agreed with Legg as to the findings and symptomatology of the condition, but did not advance any theory of etiology except that trauma was worthy of consideration although he did not find it present in all his cases. He asserted that the material at the Tuebingen Clinic had nothing to offer in support of the theory of mild osteomyelitic infection in early childhood as an etiological factor.

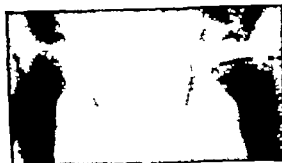


Fig. Case June 914 Roentgenogram taken at the time of the patient's first trauma, showing no changes in the hip joints.



Fig. Case October 916 Fourteen months after the original trauma, showing changes in bone characteristic of osteochondritis deformans juvenalis.

These papers by Legg and Perthes were undoubtedly the first to contain accurate descriptions of osteochondritis deformans juvenalis but Freiberg (8) in 1905 described two cases under the designation of arthritis deformans coxae juvenalis, the chief clinical interest of which lay in the impossibility at that time, of distinguishing them from adolescent coxa vara without the aid of the roentgenogram. Thus much earlier than their European confrères did the American profession differentiate the condition from tuberculous coxitis.

Brandes (2) in 1914 carefully reviewed the literature and reported ten cases giving histories and roentgenographic findings. He differentiated the condition from arthritis deformans, showing that the two diseases were separate entities. He inclined to the belief that some derangement in the region or vicinity of the synarthrosis of the epiphysis was an etiological factor and that trauma played no small part in the production of the disease, causing some disturbance of the arterial supply about the epiphysis which in turn caused the symptoms. He mentioned cases of his own, and cited statements of other observers confirming the occurrence of the disease in persons of the same family, which suggested an hereditary influence.

In two of Brandes' cases some doubt might be cast on the diagnosis. In Case 1 there was a positive reaction to tuberculin, the presence of meningismus, and later in the course of the disease night cries and the demonstration in the roentgenogram of the presence of rarefaction of the femoral head. These symptoms

do not appear in the cases reported by most observers. In Case 6 a history of tuberculosis in the family and the presence of creaking in the joint on flexion, are rather in contradiction to the observations of other men who make a point of distinction between the absence of creaking in osteochondritis deformans juvenalis and its presence in arthritis of the juvenile type.

Brandes (3) in 1920 gave an account of the end results of the ten cases reported in 1914. As a result of his study he made three points of observation:

1. Osteochondritis deformans may appear as a secondary malformation after congenital luxation of the hip.
2. It may be hereditary, appearing in children of the same family or in families where congenital luxation of the hip is found.
3. The disease is not infrequently bilateral. These observations have not been confirmed by any other writer except that many observers have found that the disease may appear after reduction of a luxated hip, which Legg considers a confirmation of his theory of trauma.

Delitalia (6) in 1915 gave a complete résumé of the disease in all its aspects. He cited one case where the disease occurred in a member of the same family and mentioned other writers who had observed the familial type. He reported one case where trauma was apparently the etiological factor, did not observe any cases in which tuberculosis appeared to be the etiological factor, and noted the preponderance of the occurrence of the condition in the male. In speaking of the

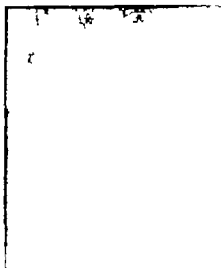


Fig 3. Case March, 97. Some improvement in bone condition.

similarity of coxa vara and osteochondritis deformans he said.

In both conditions the essential of the process is a disturbance and partial arrest of the cartilage ossification. In the coxa vara there predominates an atrophy of the lower medial part of the neck, in Perthes disease at the exterior upper part, but while in the first only the cartilage is affected and the cephalic nucleus which has appeared in the third month of life, continues to develop normally in the second there is also a trophic process



Fig 4. Case June 9. 17 years after the original trauma showing typical ankylosed deformity. The patient has perfect function, no limp, and no shortening.

causing it to develop in an irregular and incomplete manner. And since the alterations which are remarked in coxa vara correspond to the territory of one of the three terminal arteries which according to the studies of Lever serve the nutrition to the upper end of the femur and since in Perthes disease these correspond to the territory of the other two arteries, one can think that the same disease cause acting now in one part and then in another has produced the two different clinical entities. In the one case the deficiency of osseous trabeculae at the interior part of the femoral neck which form an important part of the pressure lines allow the epiphysis to curve toward the lower part. In the other the incomplete ossification of the medrum and upper part of the neck, weakening the mechanical traction lines allows the epiphysis to lodge there and become crushed.

What the reasons are for this derangement of growing cartilage in the cephalic nucleus, it is not possible to ascertain. We may exclude, due to the anatomopathological observations

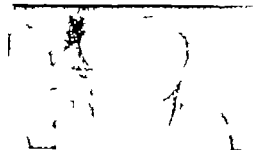


Fig 5. Case June 971. Mottled appearance of the epiphysis, which is typical at the onset of the disease. Contrast with Figure 7.



Fig 6. Case July 971. Mottled appearance of the epiphysis less marked, and beginning medullary deformity.



Fig 7 Case March, 9 The moth-eaten appearance of the epiphysis (see Figure 3) has disappeared, and the characteristic mushroom deformity is well marked



Fig 8 Case September, 9 Enlarged femoral head, mushroom deformity and short femoral neck

made all infectious processes, traumatic causes rickets, and we finally must resort to a very early disturbance, probably congenital of the epiphyseal organ of growth

Although from this observation he rules out traumatic causes, it would appear that his line of reasoning in support of the theory of congenital or early disturbance of epiphyseal organ of growth is identical to that of Legg in support of the theory of trauma, which will be given later in this paper

Delitalia summarizes his observations as follows: One can say that the disease makes its appearance during periods of full and general good health in people not affected by tuberculosis, syphilis or any other infectious disease at an age ranging from 4 to 11 years mostly prevalent in the male sex, on one side only

Taylor and Frieder (22) in 1915 reported their observations in nineteen cases. Their conclusions were as follows:

"1. Quiet hip disease osteochondritis of the hip or Perthes disease is not tuberculous or syphilitic, but a distinct morbid entity with characteristic symptoms, roentgenograms, course and termination

2. It is benign and fairly common

3. Simple treatment only is needed and the prognosis is good

"4. Its inclusion with tuberculosis of the hip falsifies statistics and leads to errors in prognosis and treatment

5. It is one cause of adult osteo-arthritis of the hip

Four of their cases gave histories of trauma, but in view of the fact that it had occurred so long before they did not support the theory of trauma. They did not, however advance any definite theory of etiology

Allison and Moody (1) in 1915 reported in detail eight cases of this disease also three cases of similar changes occurring in the shoulder radius, and tibia which they considered not unlike those occurring with osteochondritis deformans. Their observations led them to the following conclusions: We are inclined to believe, from the foregoing that osteochondritis deformans juvenalis is a disturbance of the line of epiphyseal growth, and that it depends for its typical development upon changes in circulation which destroy the nice balance which exists between metaphysis and epiphysis in growing bones

In order to determine the influence of slight injury on the epiphysis they performed six experiments on rabbits in all these the results were negative for production of the disease although in only two cases were the observations made after a period of 5 weeks, which might account for the negative results

Treiberg (9) in 1916 reported two cases of osteochondritis deformans coxae juvenalis and mentioned the fact that in 1905 (8) he described two cases under the designation of arthritis deformans coxae juvenalis. In this





FIG. 9. Case 3 March, 9. Typical mushroom deformity and shortening of the femoral neck.



FIG. 10. Case 3 May, 9. Same Case as Figure 9, 3 months later, showing decided improvement.

paper he did not associate the disease with trauma, he believed that the condition was the result of an infectious process, perhaps in the tonsils, and that in all cases thorough search should be made for foci of infection.

Legg (16) in 1916 in a most classical manner brought forward his reasons for ascribing to trauma the rôle of causative agent in the production of this condition. He divided them into three classes:

1. Cases of known trauma.
2. Negative cases or those in which no definite history of trauma could be made out.
3. Cases of operative trauma following reduction of congenital luxation.

Of the etiology of the condition he said: "I offered in 1909 therefore the hypothesis of trauma as the first cause producing a disturbance in the circulatory relation between the epiphysis and the neck of the femur, the immediate result being atrophy in the former through a diminished blood supply and hypertrophy in the latter. The hypertrophy seemed to me to be related to the hyperemic condition induced not only temporarily by traumatic congestion but maintained for considerable length of time by a proportionately increased blood supply, where the blocking of the epiphyseal channels distributed a heavier circulation to the neighboring diaphyseal vessel. Adding to this disturbance the factors of pressure and growth also through a definite period of time my conclusion as to ultimate result was that pressure upon the epiphysis, atrophied by diminished blood supply, produced flattening of that growth, as especially stimulated in the hyperemic upper diaphysis, produced thickening

in the neck and modification in shape approximating the varus condition."

Up to that time no one had laid a better foundation in support of a theory of the etiology of this condition. The reasoning and anatomical basis for Legg's belief cannot be overlooked. In this paper he suggested also that the disease be named osteochondral trophopathy, which he asserted was descriptive of the condition.

Kidner (14) in 1916 asserted that various authors had described the course, symptomatology and treatment of this disease, but few had written anything about its etiology. He reported that in one case on which he operated he found in a small necrotic area a staphylococcus aureus of low vitality. He therefore believed that the disease was due to a low grade hematogenous infection, and for this reason that the logical treatment to hasten recovery and limit destruction would be the clearing out of this focus. This theory of infection was based on one case only and operation, which perhaps gave good results in the hands of a careful operator such as he, seem rather a hazardous treatment to recommend to the average surgeon who might ignore the epiphysis and destroy too much, thereby stunting for all times the normal epiphyseal growth. Legg reported a similar finding in one case in which he operated but he considered the infection to be coincident, rather than a causative factor in the production of the disease. Gibney (13) in 1917 mentioned Legg's contribution as the first information on this condition, and Perthes' article as the second. He described in detail several cases but offered no theory of etiology.

Legg (17) in 1918 again advanced his reasons for the theory of trauma, and quoted several authors who substantiated his views. He gave reasons why he could not accept the theory of rachitic origin as advanced by Calvé of congenital origin, by Delitalia, or of infectious origin as supported by Kidner and Freiberg.

Francisco (10) in 1920 reported in detail two cases of the disease in one of which there was a history of trauma. He believed that the condition could be ascribed to improper development, but offered no explanation for such improper development. In a later paper (11) published the same year he still believed the condition to be the result of improper development of the head and neck of the femur and that it might involve other lines. If however we accept this theory we must find the causative agent which produces the faulty development and since none has been advanced we can accept this theory only as a speculative one. Legg and the writer have each reported a case in which roentgen ray examinations have shown first a normal hip and later the typical changes observed in osteochondritis deformans juvenalis. Were the condition the result of faulty development, the causative factor must have been present when the first roentgenograms were made. Each of these cases could be accounted for by trauma.

Fairbank (7) in 1921 after giving a description of the disease as recognized today concluded as follows: "As to the nature of the affection nothing definite is known. The theory which receives the greatest amount of support is that trauma produces damage to the blood supply of the head of the femur and that the changes in the ossification of the bone are secondary to this damage. Developmental error as a predisposing if not the sole cause, local infection and rickets have all been suggested in explanation of the appearances. Tuberculosis and syphilis can undoubtedly be ruled out of court. Suffice it to say that there are difficulties in the way of accepting the traumatic theory."

Buckley (5) in 1921 reported a case of osteochondritis deformans occurring in a Jewess 32 years of age. In this case he observed similar changes in other joints and

believed faulty development to be the causative factor. He said: "Probably the predominance of the symptoms in the hip joint is to be explained by the insufficiency of bony development in the epiphysis of the head and consequently its inability to bear the weight of the body and the strains normally thrown on that part of the bone the result being an intracapsular fracture."

If we consider as osteochondritis deformans juvenalis only those cases which show in the early stages the typical broken-down appearance of the femoral head and in the later stages the mushroom deformity it is rather difficult to consider this condition as an intracapsular fracture.

Pernster (20) in 1921 reported a case in which operation was performed. The findings being similar to those of Kidner and Legg. Although in his case the cultures were negative while in the others staphylococci were found from his pathological findings he inclined to the belief that the origin was infection, with trauma playing the important rôle in localization. He advocated operation as the treatment of choice, but warned against destruction of the epiphysis which in the writer's opinion is one of the dangers of operation which is not emphasized strongly enough as in unskilled hands the results may be far more disastrous than if the case were treated conservatively.

Rodenck (23) in 1921 after reviewing the two types of limp painless and painful and the method of examination in suspected cases said in conclusion: "A large percentage of recorded cases give a history of injury 4 to 6 months previously. It is certain, however that it must be one of three pathological processes: new-growth inflammation or degeneration, due to some circulatory disturbance."

Platt (21) in 1922 wrote the most comprehensive article on the disease since Legg's articles in 1916. He reviewed the entire literature from early history up to date and the article is well worth reading. He reported in detail 35 cases under the following groups:

- 1 Pseudo-coxalgia in children
- 2 Pseudo-coxalgia the end result in adult life

3. Arthritis deformans juvenalis of the hip joint

4. Miscellaneous hip-joint affections in which flattening of the femur is seen *covax plana*

After giving reasons why he could not accept the theories of etiology advanced by various authors, he concluded in support of the theory of infection

1. Pseudo coxalgia or osteochondritis deformans juvenilis *covax* is an inflammatory lesion of the upper end of the femur the changes being subchondral in location

2. The condition is most probably due to a definite infection of low grade virulence. It is impossible to postulate the exact site of the primary implantation of the infection, which reaches the femur by the bloodstream in the well marked a five phase all the joint elements participate in the cycle of osseous changes

The disease is to be regarded as a definite pathological entity among the hip-joint affections of childhood

4. Pseudo coxalgia shows a definite predilection for the second half of the first decade of life

5. In the period of adolescence the reaction of the hip joint to the type and grade of infection which produces pseudo coxalgia at an earlier age is manifested by the production of an arthritis deformans. Arthritis deformans juvenilis is never seen during the age period appropriate to pseudo coxalgia

Yvernault (25) in 1922 reported a case occurring in a man 1 year of age in which both hips were involved the right more advanced than the left. In view of the fact that this was a patient of intelligence from whom no history of trauma could be elicited other than injury to the right knee at 7 years of age. Yvernault considered the case to be in favor of the theory of congenital origin

#### THEORIES OF ETIOLOGY

All writers on this disease agree as to the symptomatology the diagnosis and in the main, the treatment, a few advocating operation as the most favorable treatment, while the majority advise rest both by relief from weight bearing and application of a plaster

spica. The debatable question is the etiology and in the literature the following possible causes have been mentioned (a) rickets, (b) syphilis (c) congenital abnormalities, (d) variations in the endocrine glands, (e) infection and (f) trauma

**Rickets** If one accepts the present day theory that rickets is due to a deficiency of the soluble vitamins and to a lack of sunshine and exercise osteochondritis deformans juvenilis cannot be associated with rickets. Again osteochondritis deformans juvenilis is more common in males than in females, which is not true of rickets. It occurs most commonly between the ages of 3 and 8 years which is not the case in ricket and the roentgenographic finding in the two diseases are not in any way similar. Therefore this cannot be considered a favorable theory of etiology

**Syphilis** No evidence has yet been advanced indicating that syphilis has any bearing on these cases. The Wassermann reaction on the blood is invariably negative the bone picture is in no way typical evidences of syphilis in the bones skin or mucous membranes have not been found and the patients recover without antisyphilitic treatment. Roberts (24) is the only author the writer has been able to find who favors this theory

**Congenital abnormalities** If congenital abnormalities were etiological factors the condition would be present at birth but so far no such cases have been reported. Again, cases have been reported in which roentgenograms have demonstrated a normal hip, and later roentgenograms have shown evidences of the disease. This would rule out congenital abnormality as an etiological factor

**Variations in endocrine glands** The theory of disturbed endocrine glands may be dismissed without comment until the function of these glands in development of bone is ascertained

**Infection** Of the several etiological theories advanced for this disease those of infection and trauma have received the most attention. The early writers did not give much attention to infection in fact it was not until the condition was well established as a disease entity that infection was advanced as an etiological factor. The theory of infection has been ad-

vanced especially by Kidner, Phemister and Freiberg. The two former have had operative cases. In Kidner's case a staphylococcus of low virulence was demonstrated while in Phemister's case no growth was obtained. Freiberg based his conclusion on the characteristics of the disease, its onset, fever, etc., but the writer is inclined to think that Freiberg's case is not the typical picture seen in the majority of cases and should not be considered as of the usual type, but rather one in which an infection was superimposed on the process. With regard to Kidner's and Phemister's views, the writer while believing that infection may be secondary, cannot view it as the primary cause, were this so, one would expect to see other joints involved and the literature contains little suggestion of a like process in other joints, except in the work of Moody and Allison who reported what they considered similar changes in the shoulder, radius and tibia. They inclined to the theory of trauma, however, and all their cases gave histories of trauma. Were infection the primary cause, one would expect to see in some case a virulent infection, if the general condition was poor, or if the disease were hematogenous as suggested by Kidner, at least its uniform occurrence in males and females.

**Trauma.** The majority of writers support the theory of trauma, which the writer has found to be well sustained by the clinical findings in cases which he has observed, three of which are reported in detail.

**CASE 1.** C. R., boy, 9 years of age, was referred to the writer in October, 1916, with a diagnosis of tuberculosis of the right hip.

The family history was negative. The previous personal history was negative except for scarlatina at 4 years of age. Two years before he had been struck on the right hip by a automobile. There was no evidence of severe injury; the roentgenogram was negative and after 3 days in bed he was up and playing about as usual. He presented a quite normal child a year later when his mother noticed that he limped. Inquiry at that time showed that he had jumped from a shed 3 weeks before, but had not sustained any severe injury. This was the only injury he had had after the trauma of 3 years before.

The general physical examination showed a well developed, well nourished boy and was negative except for the condition of the right hip and leg. He complained of some pain in the anterior region of the right hip. He had no fever and no night cries.

He walked with a marked limp, and there was some atrophy of the right hip and buttock, slight limitation in the internal and external rotation of the joint. There was no limitation of flexion, abduction and adduction and no pain on any motion. Measurements showed one half inch shortening of the right leg with three quarters inch atrophy of the thigh and one quarter inch atrophy of the leg. The roentgenogram showed changes typical of osteochondritis deformans. Patient was placed in plaster cast from axilla to ankle in the abducted position with instructions to remain as quiet as possible. He was kept in the cast for 6 weeks, a short Lorenz spica was applied for 6 weeks, followed by a flannel spica.

Examination 4 months from the time of his first visit showed no shortening, no limp and no pain. Slight atrophy was still present in the region of the buttocks. A roentgenogram showed some diminution in the bony changes about the epiphysis.

**CASE 2.** No. 1050. C. L., girl, 5½ years of age, was brought to the Clinic in June, 1921, on account of limp. The family history was negative. The father and mother were living and well, one brother and one sister were living and well and there was none dead. The patient had had measles at 3 years of age, and enuresis for the past year. In December, 1920, she struck her left hip while sliding in a school yard. There was no immediate disability, but 3 weeks later she began to limp. decidedly, there were no night cries, no loss of weight, and no complaint of pain in the hip. The limp continued and seemed to the mother to grow worse. She was told by a doctor that her daughter had tuberculosis of the hip.

The child was well developed and well nourished and walked with a marked limp of the left leg. The general examinations, including urinalysis, Wassermann test, and examination of the blood were negative; the leucocyte count was 7,000. Examination of the left hip showed some prominence of the left great trochanter but no shortening. The Trendelenburg sign was positive. There was a centimeter of atrophy of the left thigh, measured 6 centimeters above the superior border of the patella, as compared with the right. There was no pain on movement of the joint in any direction but there was some limitation of the range of the joint in abduction and internal rotation. The roentgenogram showed the typical early deformity of osteochondritis deformans juvenalis with the moth eaten appearance of the epiphysis.

A plaster spica with the leg in 20 degrees abduction was applied, and the patient placed on crutches. At the end of 6 weeks, a flannel spica was applied. The patient continued to use crutches for 3 months, after which time weight bearing was gradually permitted with exercises aiming to increase the range of abduction. At the end of 16 months there was no pain, no limp, no shortening and no atrophy. A roentgenogram taken at that time showed the typical mushroom deformity of the later stages of the disease.

CASE 3. A 5643 L M boy 15 years of age as referred to the Clinic in December 1920 with diagnosis of tuberculous of the hip and with request for roentgenographic examination and advice as to treatment. The family history was negative. The personal history was negative except for the condition of the hip. In March, 1920, the patient had injured the left thigh and leg while jumping, but this was not considered as fallacious. Two months later he began to limp, but did not complain of any pain. He was cared for by his family physician who advised him to use crutches and not to bear any weight on the leg. This treatment was carried out until December 1920 when the patient came to the Clinic.

The general examinations were negative except for the condition of the left hip. There was no trophy or shortening, and no complaint of pain but some limitation to abduction and internal rotation. The roentgenogram showed the mushroom deformity typical of osteochondritis deformans juvenalis. Continued rebel from weight-bearing for 3 months as advised.

The patient came under observation from time to time, and roentgenogram taken in May 1921 showed decided improvement but the characteristic deformities of osteochondritis deformans juvenalis were still present. The general condition was excellent and there was no limp, no pain, and no shortening.

These three patients gave definite histories of trauma. The patient in Case 1 had a negative roentgenogram at the time of his first trauma and the typical deformity of osteochondritis deformans juvenalis 2 years later which would appear to rule out the theory of congenital malformation.

### CONCLUSIONS

1. The typical changes as found in this condition should be classified as a separate disease entity under the name of osteochondritis deformans juvenalis.

2. The condition has a definite symptomatology.

3. It is due to trauma which causes a disturbance of the arterial supply about the epiphysis. An infection may be superimposed on the original process.

4. Osteochondritis deformans juvenalis should not be confused with tuberculous coxitis.

5. Children from 3 to 10 years of age who have painless limp, should have roentgenographic examinations to rule out the possibility of osteochondritis deformans juvenalis.

6. Treatment should be by relief from weight bearing and by application of a plaster spica for from 3 to 6 months. Operation is indicated in but a small percentage of cases.

7. The end-results will be good invariably if the proper treatment is carried out.

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DIVERTICULA OF JEJUNUM—A CASE WITH ENTEROLITH CAUSING  
INTESTINAL OBSTRUCTION

BY CHARLES M. WATSON, M.D., PITTSBURGH, PENNSYLVANIA

WHILE diverticula of the large bowel and more recently those of the duodenum are found not infrequently examples of their presence in the jejunum are still rare. Since Sir Astley Cooper in 1844 reported a necropsy specimen with multiple diverticula in the jejunum but twenty-five additional instances have been collected by a careful search of the literature. With a few exceptions these were discovered at necropsy in individuals dying of ailments in no way related to the diverticula.

In 1921 Terry and Mugler reported a patient upon whom an operation was performed for intestinal obstruction where the obstruction was found to be caused by an enterolith which had formed in a diverticulum of the jejunum. In May of the past year I operated on a man of 73 suffering from obstruction in whom we discovered multiple diverticula of the jejunum. One large one was distended with an enterolith the weight of which by traction and angulation was causing the intestinal block.

The history and operative findings in this case are as follows:

Benjamin P., an American, age 73, straight, slender and well nourished, a very well preserved old gentleman. Ten days before admission to the Presbyterian Hospital he consulted his physician, Dr. C. S. McGeorge on account of pain in abdomen. Previous to this he had experienced more than usual trouble in getting bowels to move, also some gaseous distention and disinclination for food, but no vomiting or diarrhea unless induced by cathartics. Difficult in overcoming constipation was becoming progressively more marked. He had noticed no blood in stools.

On palpating abdomen his physician discovered a firm rounded walnut-sized tumor a little to the right and below the umbilicus. The mass was movable but not particularly sensitive.

On entering hospital the abdomen was soft, but slightly distended, while the distended coils of intestine with their active peristaltic efforts were readily discernible through the abdominal wall. He presented the wear of an old gall-bladder operation. This was performed elsewhere after a second attack of epigastric pain 7 years ago. Patient felt

that this operation benefited him little or none, and it required a great deal of persuasion to induce him again to come to a hospital.

Owing to the partial obstruction a barium meal was not given but an enema instead. Dr. George Gruer made the following report: There is a constant constriction and partial obstruction to the barium enema in the lower part of the sigmoid. We believe there is an organic lesion of the sigmoid.

Operation, May 4, 1922. Incision was made through middle of left rectus. A firm rounded tumor was found between the layers of jejunal mesentery near the apex of the proximal loop. This was causing an incomplete obstruction by traction from its weight with the resultant angulation. The tumor also encroached upon the intestinal lumen. On proximal side the jejunum was of large caliber with thick walls. The tumor was about the size of an unhulled walnut, hard and smooth. But one coil of intestine was delivered. Throughout its exposed extent, at quite regular intervals were distributed diverticula on the mesenteric border. They were thin walled, empty and of nearly uniform size averaging about 1/2 inch in diameter.

Eight inches of jejunum and its mesentery with the involved tumor was resected, and an end-to-end anastomosis made. We believed the lesion to be malignant (carcinoma) growing from the wall.



Fig. 1. Multiple diverticula of the jejunum with partial intestinal obstruction from an enterolith within the largest one.

of di eriticulum and distending its lumen and cording it solid both intestine and mesentery with the cuticle wide of the new growth. The left colon and sigmoid were examined and found normal.

On section of tumor found it consist of a large terolith tightly distending a di eriticulum. The rest of intestinal segment ere found additional di eriticula much smaller than the one containing the stone and causing the trouble.

The patient left the hospital 5 weeks and returned to his business at an early date. His physician reports him well.

The numerous di eriticula aside from the one containing the stone, are empty free from di eriticum and presented no evidence that they had any causal trouble. They ere situated between the layers of the mesentery of fairly uniform size and placed at such regular intervals as to suggest a junction of their neck to the mesenteric artery the intestinal wall from its mesentery.

The following are brief abstracts of the cases found in the literature.

#### JEJUNAL DIVERTICULA FOUND IN THE LITERATURE.

Coxe. Sir Asth. 844 reported a case of multiple diverticul of jejunum found at autopsy in male aged 40 dying from cirrhosis of liver. The diverticula of the type situated between the layers of the mesentery and ranging in size from pea to about 1/2 inch in relation to death of patient.

Corzillon in 860 reported 4 diverticulums the size of the egg found in the jejunum and situated between the layers of the mesentery near middle of jejunum. Discovered at autopsy in course of 50 days of placenta previa.

Osler. W. B. M. 88 reported the case of man of 65 dying of enteric attack with melena in horn of stomach he discovered 53 diverticula false in type situated between the mesenteric layers ranging in size from cherry to apple having no relation to death. For years he had suffered frequently from rumbling noises and colic like pains.

Moore in 883 in the case of man dying of bronchitis, discovered at autopsy three diverticula true in type situated in the mesenteric border associated with fracture of jejunum near its beginning and evident of congenital origin. Evidence that diverticula had caused symptoms.

Bruce in 895 reported single diverticulum in the first portion of jejunum containing all coals and situated in mesenteric border 3 by 12 millimeters in size. It was found at necropsy in man of 77 who died of peritonitis, the result of perforation from pyloric carcinoma. All intestinal coats ere present.

Bochwald and Jamel in 89, reported case found at operation, in boy of six suffering

from obstruction of the bowel, due to cystic tumor of jejunum which proved to be diverticulum the communication of which with intestinal lumen had become sealed. This was of the true type, situated on the mesenteric border probably congenital.

Virchow. 890 reported an autopsy specimen with multiple diverticula of jejunum and ileum. Those in jejunum the size of hen egg ere on mesenteric side and false in type with large openings communicating with intestine. The body as that of an emaciated old man.

Edel. M. in 1891 reported a necropsy specimen with seven diverticula of jejunum, ranging in size from least 1/2 inch to an apple, situated on the mesenteric side with blood vessels coursing over them. Many diverticula ere also found in colon. This isoma of 73.

Scappell in 895 reported a case discovered at autopsy with sack like protrusions between the layers of the mesentery in lower portion of jejunum one about the size of a nut. These ere false in type.

Good, in 1895 reported necropsy specimen in female of 77 presenting 6 diverticula in jejunum, the one in duodenum. These were false in type situated between the layers of the mesentery and over them of which vessels coursed.

Hansemann, in 896, reported an autopsy specimen found in box of 4 in which as single diverticulum in jejunum on concave surface of bowel. It is perianal attached to mesenteric plicatures.

He also reported case of man of 85 dying from pneumonia in whom he found 400 small diverticula mostly in jejunum and situated at the point of entrance of blood vessels on mesenteric border.

Grumbach. 897 discovered at autopsy on man of 73 many perianal and 13 walnut sized diverticula in jejunum. All ere on mesenteric border devoid of muscular coat. There was also diverticulum in the stomach in the duodenum, and many in the colon these also ere on mesenteric border and without muscular coat. This man died from perforating ulcer of duodenum.

Nicholls. 899 reported from necropsy on man of 64 5 diverticula in the jejunum ranging in size from pea to 1/2 inch. All ere on the mesenteric border and ere hernias of mucous and submucous coats through muscularis. This man had had double inguinal hernia for 30 years and bronchitis for 5.

Fisher in 900, reported museum specimen of portion of jejunum containing herniated diverticulum within the mesentery and with small communication with the intestinal lumen. This hernia through defect in the muscularis.

Gordimer H. C. and Sampson J. A. in 905 reported the operative findings in a woman of 45. She had had hernia appeared to be an enteric diverticulum and three weeks subsequently developed obstructive symptoms with tenderness. At operation for intestinal obstruction 3 diverticula

were found in 40 centim. ters of lower jejunum and upper ileum. They were on mesenteric border, had large openings, were false and with large vessels coursing over each one. One was acutely inflamed through adhesions; the colon was causing obstruction by kinking. I vol ed. di. criculum was removed and abdomen drained. The others were not disturbed. Patient recovered.

16 Taylor and I, in 1910, reported a necropsy specimen in woman, 168 days from previous monia in which were a large number of lymphatic ranging in size from pea to a ball, but they were situated between the layers of the mesentery and were false in type. There were two numerous sacculations in the colon.

17 B. Flour in 1913 reported a case upon whom he operated for duodenal ulcer. Several diverticula were found in upper jejunum between this portion of the jejunum its mesentery and the mesocolon were numerous adhesions which caused B. Flour to do an anterior instead of the contemplated posterior gastroenterotomy. The diverticula were not disturbed and the patient exhibited a symptom to cure evidently played no part. The symptomology. The diverticula ranged in size from a hazelnut to walnut and were situated on the mesenteric border.

18 Lat jet and Murard, in 1914, reported a necropsy specimen in woman of 50. There was single diverticulum in the jejunum, 5 by 3 centimeters in size. It was on the mesenteric border, thick neck, a relation with the blood vessel.

19 Braithwaite in 1918 reported a necropsy specimen in man, aged 45, who had died in City Hospital of another condition. There were 12 diverticula in the second portion of the duodenum and 60 in the proximal 1/3 feet of the jejunum. They were on the mesenteric side. The largest, 25 centimeters in diameter.

20 Case in 1910 reported 10 cases of jejunal diverticula found in the course of routine roentgen examination and subsequently confirmed at operation. The first, a man of 61, had complained of gastric discomfort and distress for 10 months and for the last 6 months great distress and intolerance. Perhaps a dozen diverticula were found in upper jejunum, most the size of pea but one large one 4 centimeters in diameter. There were signs of peridiverticulitis about the large one. No other findings to account for symptoms. Recovery followed by recovery.

The second case a man aged 35 with a history of gall bladder disease in whom they had found roentgen showed jejunal diverticula. He later underwent another laparotomy where during the removal of the gall bladder the presence of the diverticula was confirmed.

21 Terry and McAlister in 1921 reported the case of a woman aged 35 in whom operation for duodenal ulcer showed diverticula of the upper jejunum were found. All were located on the mesenteric side and the largest ones were 1.5 cm. in diameter.

A half later she was operated on for intestinal obstruction caused by an enterolith forming in one of the diverticula.

22 M. Williams, in 1921, found at autopsy in a man aged 71 dying from thrombosis of the superior mesenteric artery seven large diverticula in the jejunum. They were situated at the mesenteric border, in close relation with the blood vessels. They evidently bore no relation to the term nodules.

23. Blackechinle, in 1921, treated a woman aged 43 suffering from abdominal pain and progressively increasing difficulty in obtaining bowel movements. Pain more marked in past 21 months and increased in efforts to secure bowel movement. Diagnosis: Incomplete intestinal obstruction. At operation, upper jejunum for two and a half feet was found dilated 2 inches in diameter. On the mesenteric border were 13 diverticula varying in size from a pea to a pigeon's egg. Duodenum was also dilated with large diverticula also on mesenteric edge. No obstruction. No pathology other than this. A duodenojejunostomy was performed as a temporary expedient but patient died in collapse 3 hours later. At necropsy the diverticula were found to be thin walled false in type with almost complete absence of muscular coat. They were in close proximity to the blood vessel.

24. I. Akerlund's case reported by Schlegel. A thin walled diverticulum was found at necropsy in female of fifty, close to the jejunal flexure in the uppermost portion of the jejunum. It lay behind the pericardium and then distended, extended beyond the lower border of the liver. The X-ray showed a diverticulum lying just in a perforating gastric ulcer. The patient died 10 days following a posterior gastroenterotomy. At time of operation the diverticulum was not discovered.

Of the 46 instances of jejunal diverticula found in the literature 18 were revealed at necropsy in persons dying of causes in no way related to them. In only one of these is there any evidence that the diverticula had caused symptoms during life. In this case reported by Oler, a man of 65 dying of an enteric attack with melena had for years suffered after eating from rumbling noises and colic like pains.

Of the 8 cases found at operation two were unrelated to the symptoms leading to the opening of the abdomen. In one they were found in the course of an operation for gall bladder disease and in the other their presence caused the operator to perform an anterior instead of a posterior gastrojejunostomy for duodenal ulcer. Both of these patients were relieved of their symptoms and we may infer that the diverticula were re-



sponsible for no trouble. Of the remaining 6 cases in one, obstruction of the jejunum was produced by a cyst of the mesentery thought to have had its origin in obliteration of the neck of a true sack. In another operated upon for obstruction numerous diverticula were found in jejunum and duodenum but no obstruction and no other pathology to account for symptoms. One patient suffered from diverticulitis and was cured by a resection. In another obstruction was caused by adhesions, the result of a peridiverticulitis. The patient of Terry and Mugler has already been referred to. Our own case forming the basis of this paper has also previously been described.

In but two instances has a diagnosis been made by roentgen ray and subsequently demonstrated at operation both of these were made by Case.

Where sex was mentioned 14 were in males and 9 in females. The youngest was 6. This and another of 14 were single possessed of all coats, and probably congenital. The next youngest was 30, this was also single but false in type. Between 30 and 40 there were none. 40 and 50, 5. 50 to 60, 1. 60 to 70, 4. 70 to 80, 7 and one the oldest, was 85.

Those found early in life are apt to be congenital and possessed of all the intestinal coats while the acquired have been mostly observed after 45 their walls thin and commonly devoid of muscular coat—the false type in contradistinction to the former or true.

In one of the cases, reported by Hansemann, there were 400 small diverticula mostly in the jejunum. This is the greatest number found in any one instance.

Acquired diverticula are thought to be due to senile changes in the intestinal musculature, loss of adipose tissue, dilatation of the vascular sheaths as they enter the intestinal wall caused by the varying caliber of the blood vessels and to any cause tending to increase the intra intestinal tension. The mucosa or the mucosa and submucosa are pushed through the defect in the muscularis usually at the point of entrance of the larger vessels.

In support of this theory is the fact that nearly all the cases have been found late in

life are practically all on the mesenteric border either to the side of or between its layers frequently are in close relation to the larger blood vessels, and often distributed with a regularity similar to them. One diverticulum, a single congenital sac, was on the convex border the position of another was not stated all the others were on the mesenteric side.

Of the seven cases of jejunal diverticula causing symptoms, in three they were those of obstruction. In one patient, a woman of 45, there was what appeared to be an attack of appendicitis 3 weeks subsequently she developed obstructive symptoms with tenderness. Another complained of gastric discomfort and distress for 10 months and for 6 months a great deal of intestinal flatulence. In another there was abdominal pain and progressively increasing difficulty in obtaining bowel movement pain was more marked in last 2½ months and was increased by effort to secure bowel movement no obstruction or pathology other than diverticula with jejunal dilatation was found in this case.

Diverticula in the small intestine are not likely to be considered in the diagnosis of abdominal conditions, other than as a rare possibility except where their presence has been demonstrated by roentgen-ray examination. Even where diverticula have been left unmolested at operation, subsequent x-ray examination has failed to demonstrate them. The two instances of pre-operative diagnosis by Case and later proved by operation, are the only ones we have been able to find in the literature.

#### TREATMENT

In three instances, including our own case the jejunum with the offending diverticula was resected. All three recovered. In a case of diverticulitis the diverticulum was removed and the abdomen drained. This patient also recovered. A patient in whom a duodeno-jejunosomy had been performed, died shortly afterward.

In the case of Terry and Mugler at time of first operation, the larger diverticula were inverted a year and a half later an enterolith causing obstruction was crushed within the

sack, passed on through the intestine and the diverticulum inverted

Where the diverticula are excised or inverted the suture line should be at a right-angle to the longitudinal axis of the intestine and care taken not to interfere with its blood supply

Since the contents of the small intestine are liquid and in the jejunum fairly sterile these sacculations may be causing no trouble and in such a case where discovered in the course of the treatment of some other lesion and particularly so when small and multiple it will be the course of wisdom not to molest them. When however they are the seat of inflammation found as the cause of obstruction or through stagnation inducing auto intoxication surgical treatment is indicated usually inversion excision or intestinal resection

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# GANGRENE OF THE EXTREMITIES COMPLICATING PUERPERAL SEPSIS

BY VICTOR F. CHUSKY, M.D., ST. LOUIS, MO.

**P**UERPERAL gangrene of the extremities while of infrequent occurrence is of such serious consequence that it should be kept in mind and considered a possibility in every case of puerperal sepsis and septic abortion.

In 1916 in an excellent paper Arthur Stein reported 2 cases and reviewed the literature up to that date giving abstracts of 4 authentic cases besides his own. In Stein's series, 63 cases followed labor, 4 followed septic abortion and 4 occurred during pregnancy. He also reported 5 cases which followed gynecological operations. Knipe in 1917 added 1 case which followed septic abortion. To these I wish to add 1 case which followed labor (being first seen by me 10 days after delivery).

A 30-year-old married woman, first pregnancy, born about 4 years ago, delivered her first child at term about 4 hours later. Labor was uneventful and the delivery was normal. There was no hemorrhage and her perineal lacerations were slight. The child was born alive and the placenta and membranes came out without difficulty. The day after delivery she had severe headache, felt nauseated and had some fever but she did not know how much. The evening of May 3, 4 days after delivery she developed high fever, felt ill and there appeared over the body and extremities a fine red eruption. The temperature rose to 104 or 105 degrees and remained high. The eruption disappeared in 4 or 5 days. There was never any sore throat or cervical dematitis although diagnosis of scarlet fever had been made. On the morning of May 8, 6 days after delivery she complained of feeling of numbness in the feet. It was then noticed that both feet showed a bluish red discoloration which extended to the ankles and that both feet were slightly swollen. By 5 p.m. of that day she began to complain of severe pain in both feet. This pain continued and became so excruciating that morphine had to be given frequently for relief. She complained bitterly when heat was applied and was relieved that cold applications relieved the pain.

When seen by me, on May 9, 9 days after delivery the patient presented a picture of severe sepsis. The temperature was 104.5 degrees, the pulse rapid and weak and prostration as great. Both feet were of bluish red color extending up to the ankles, the toes being almost black and beginning to become

dry. The swelling extended half way to the knee and there was no definite line of demarcation. The feet were cold and there was no pulsation in either dorsalis pedis artery. The femoral or popliteal arteries did not feel thrombosed. This condition persisted for about a week, the pain being almost unbearable after which the circulation in the feet began to improve. The symptoms of the toxemia of the feet began to disappear but the ends of all the toes became hard and dry, the line of demarcation forming at the distal articulation of each toe. The dry gangrenous portions were removed. By June 6 when last seen she was still half dead with fever reaching as high as 104 degrees each day. She had large indurated nodes in the right side of the pelvis and the fundus of the uterus was fixed. The toes were healing. There was no trouble. She subsequently made a complete recovery.

A review of the reported cases shows that puerperal peripheral gangrene occurs most frequently in the lower extremities involving one or both, less frequently in the upper extremities and rarely involving a hand and a foot. In one case there was symmetrical gangrene of the fingers, toes and ears.

## ETIOLOGY

It is not the purpose of this paper to discuss the etiology of gangrene in general. It is known to occur in practically all the acute and chronic infectious diseases as well as in all the chronic wasting and cachectic diseases as a result of thrombosis or embolism. Puerperal peripheral gangrene occurs following occlusion of an artery or vein or both, this circulatory block being brought about by the following means: Arterial embolism, coming from deposits on the valves of the left side of the heart in a complicating septic endocarditis or from thrombi forming chiefly in the left auricle as a result of endocarditis. An embolus might also come from thrombosed pelvic veins and reach the left side of the heart through a patent foramen ovale. Wanner, Oliver and Papou reported cases of this kind and cases are cited by Welch in connection with other diseases. Emboli may also come from the detachment of a piece of thrombus in a large

artery which is arrested peripherally where the vessel lumen is smaller.

Arterial thrombosis may occur by a thrombus in the uterine artery or its branches in the placental site growing by extension until it reached the internal iliac from whence it might extend up the common iliac to the aorta and down the external iliac to the femoral and its branches. Arterial occlusion may also occur from thrombus formation as the result of a septic or toxic endarteritis anywhere in the arterial system or from a secondary endarteritis through propagation of infection by contiguity from an adjacent vein.

Venous occlusion may occur as the result of a septic or toxic thrombophlebitis or by the extension of a thrombus from the veins of the broad ligament into the iliac vessels to the vena cava and down into the femoral vein. It may also occur by the extension of infection by contiguity from an adjacent artery producing a thrombophlebitis or by the interruption of the circulation in the concomitant artery. In the so called arteriovenous thromboses a thrombus forms secondarily in one system due to complete blocking of the circulation in the other. In many cases it is difficult to tell where the clot first formed.

The causative factor in puerperal peripheral gangrene is infection. In the study of the material in the literature it is noted that infection was invariably present. This varied from a mild infection with a low temperature lasting only a few days to the most severe type of puerperal sepsis. Either a streptococcus or a mixed infection was present. Knipe's case showed bacillus aerogenes capsulatus and Gram positive cocci in pairs and in chains.

The circulatory block in most of the cases was the result of an endocarditis the deposit on the heart valves acting as an embolus or of a septic or toxic endarteritis and thrombus formation. Puerperal gangrene of venous origin is relatively rare. Varicose and thrombotic veins of the genitalia are common during pregnancy and after childbirth and phlegmasia alba dolens, the result of obstruction of the iliac veins frequently complicates labor yet rarely terminates in gangrene.

Contributing causes of thrombosis are low blood pressure and sluggish blood stream

caused by severe hemorrhage or weakened heart action recumbent position and relative immobility of the entire body lowered resistance against infection and according to Mendel abnormal constitution of the blood favoring thrombosis.

I believe that my case was due to arterial occlusion the thrombus being located in the pelvic vessels perhaps extending into the femoral vessels. The gangrene was dry the legs were not edematous as one would expect with extensive venous thrombosis, the circulation re-established itself in all parts except the distal ends of the toes. Occlusion of the femoral or iliac arteries usually affect only the feet or even the toes while blocking of the popliteal or anterior and posterior tibial arteries usually causes gangrene up to the obstruction. Pulsation in the dorsalis pedis was absent no thrombosed veins were palpable and there was no evidence of endocarditis.

#### SYMPTOMS

Infection being the etiological factor a fever always precedes the onset of the symptoms of circulatory blocking. This may be only a slight rise indicating a mild infection or a temperature of 104 or 105 degrees indicating the graver types of puerperal infection. A septic endometritis was present in practically all of the cases reported. Pain is always present and is usually excruciating. The severe pain usually subsides when the line of demarcation forms and the general condition of the patient becomes worse due to the absorption of necrotic tissue elements. Sensation is diminished in the affected part early and there is often increased sensitiveness to painful impressions. Motion is not interfered with. A discoloration of the affected area with diminished local temperature is present in threatened gangrene. Demarcation finally takes place but death may intervene from general sepsis before the line of demarcation is established.

#### DIAGNOSIS

The diagnosis of a threatened or an existing gangrene is obviously not difficult. Differentiating between an arterial or venous block or finding the location of the obstruction is often difficult and some times impossible. An

abrupt onset usually points to an arterial blocking, Stein says. The early appearance of gangrene in the first few days of the puerperium points to an arterial (the most common) origin. The absence of arterial pulsation below the obstruction is found in arterial blocking. The gangrene is usually dry in arterial occlusion and moist in venous. Local edema, however, is usually characteristic of venous blocking. Thrombosed pelvic veins are often palpable by rectum or vagina.

#### PROGNOSIS

The prognosis is bad. There is at least a 50 per cent mortality. The mortality is governed by the time amputation may be done and the extent of the puerperal infection. Whether the block is arterial, venous or arteriovenous has no bearing on the mortality.

#### TREATMENT

Prophylactic measures consist in the induction of labor cases in a manner to prevent puerperal infection and if it is present to abstain from intra uterine meddling. Heart stimulants should be given to increase blood pressure when the heart is weak. The patient should be kept as quiet as possible to avoid loosening thrombi when formed and palpation of affected veins should be as gentle as possible or dispensed with altogether. All unnecessary movement or manipulations should be avoided. Sodium citrate has been advocated as a prophylactic measure against thrombosis in typhoid fever. It might be used in puerperal sepsis.

Active treatment consists of treating the puerperal infection as well as the affected part. The affected extremity should be elevated in venous blocking. It should be kept warm by the application of heat by means of hot fomentations of lead water and opium which also helps lessen the pain. Morphine should be given for pain and the circulation should be sustained by heart stimulant. An early amputation is the most important factor when the condition is such that one can give it. The occlusion. Some work has already been done in removing emboli from arteries and as the skill in this vessel surgery increases this may become the proper way. Unfortunately many of these cases, but a yet the technical difficulties are too great.

#### CONCLUSIONS

Puerperal peripheral gangrene will not uncommonly occur in any case of puerperal sepsis or septal infection.

It is usually preceded by infection.

It is most frequently of arterial origin.

The mortality is 50 per cent or more.

The most important step in the treatment is early amputation of the gangrenous part.

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## CHRONIC APPENDICITIS—IS IT A MYTH?

BY JOSEPH RILUS EASTMAN M D F A C S INDIANAPOLIS, INDIANA

PHYSICIANS like other men are often victimized by first impressions from which they escape only with great difficulty. It is true that by doubting we come to question and by seeking we may come upon the truth (Abelard) but it is also true that man is disposed nowadays to view with distrust almost any long established institution or idea whether good or bad often for little reason excepting that it is old and established and respectable.

A somewhat oracular and at the same time iconoclastic dictum recently passed down from a medical Parnassus on the Atlantic seaboard has had the effect of disquieting many internists and a respectable proportion of surgeons in their attitude toward chronic appendicitis. The wide circulation given the bright laconicism in question and the high position and character of its author have caused in some quarters what one might designate as an attitude of distrust toward surgery in the treatment of chronic appendicitis. The declaration to which I refer is familiar to most physicians. It is: There are two kinds of appendicitis, acute appendicitis and appendicitis for revenue only. With respect to this assertion the attitude of some of us is for the present at least one of respectful discredence.

The delightful epigram quoted has directness and force as well as piquancy. It is as clean cut as freshly minted coin. It has in it at least a tinge of truth but it is pregnant with mischievous possibilities. As to the tinge of truth all of us know that there are ill prepared surgeons who jump quickly to the conclusion that right-sided, lower abdominal pain in a man means appendicitis surgery and also that there are unconscionable surgeons who are ready to operate upon as appendicitis cases any one who as Haggard observes, will lie still long enough. For all these the snappy admonition noted is appropriate and needed but what of the possibilities of mischievous misguidance which lurk in its challenge.

Assuming that this view is to dominate us what then is to be the attitude of practitioners and laymen toward interval operations. Consider the probable misinterpretations. What cases are we to embrace under the heading

Acute Appendicitis Requiring Operation? What impression would be left by our withdrawal from the field of chronic appendicitis like an army defeated through its own sheer stupidity? Bernarr McFadden would know how to evaluate such a movement. Let us make no illusions for ourselves. All of his kind would seize upon and utilize it to their advantage as they did similar material in the case of another widely heralded pronouncement to the effect that 50 per cent of diagnoses made in one large and much honored hospital were erroneous. The autopsy cases were of course, the puzzling ones and the 90 per cent of all cases seen by doctors and which recovered are ignored. This, however is of negligible interest as compared with the dangerous confusion which the apothegm we are considering tends to create in the minds of physicians.

A confusion must result from a too liberal interpretation of the admonition that surgery in chronic appendicitis has little or no value. Many surgeons are of course, yet to be convinced that surgery is valueless in chronic appendicitis and some are of the opinion that general support of the non-surgical plan of treating chronic appendicitis would kill as many as an army corps in this country every year but assuredly very few of us were prepared for the almost violent assertion made in a recent article that "chronic appendicitis is a myth." Is not this opinion in conflict with elementary basic principles of pathology? Upon what study or authority does the denial of a chronic stage to this particular inflammatory process rest. For example may not intestinal parasites or irritant bodies induce a chronic inflammatory process in the appendix? One could bring volumes of case reports with pathology findings proving the entity of chronic appendicitis, and on the other hand

one cannot call to mind any meritorious effort on the part of any pathologist to sustain the view of those clinicians for whom chronic appendicitis does not exist.

If the statements thus far made mean anything they mean that there is at present wide divergence of view among intelligent physicians as to whether chronic appendicitis exists as an entity in pathology and that there exist more widely divergent views as to whether the condition its entity in pathology being admitted has any standing in clinical surgery. For such a widespread conflict of opinion there must be a reason of wide application. This reason is perhaps to be sought in a general misunderstanding of the nature and behavior of chronic appendicitis especially in its broader relations and associations.

The narrow view of chronic appendicitis and the one commonly held if one may be acquitted of pedantry is set forth in nearly every text on the subject. Most textbooks in their chapter on this matter treat chronic

appendicitis as a distinct and separate pathological entity whereas chronic appendicitis so long as it remains chronic, is interesting almost solely because of its associated pathologies—effluxes sequite, etc.

Meuvrier in 1759 (1) reported a perityphilitic abscess due to the presence of a needle in the vermiform appendix. LaMotte in the same publication several years later found an enterolith in the appendix with appendicular peritonitis. Laugier Villermet in 1824 and Meier in 1871 (2) described appendicitis gangrenosa. Later Laudet called attention to the relationship between ileocecal abscess and infection of the appendix and so articles have been written down to the line of Morton, Fitz and McBurney nearly all studies of the infections of the appendix have been addressed to the acute or abscess stage.

There is however without any doubt a chronic form of appendicitis. Moreover there are chronic types of appendicitis which apparently have never passed through an acute stage (3) and which either continue indefinitely in the chronic form or finally through faulty drainage augmentation of bacterial agents, and lessened resistance develop the phenomena of acute infection.

It is probable, however that many of these apparently purely chronic forms result from light clinically overlooked acute attacks for example the milder acute attacks of very early childhood. Wilms believes that such low grade acute forms are much more common in infancy than is generally recognized. Moreover the infant may come into the world with a chronic appendicitis. Peritonitis of the fetus *in utero* is an established fact. The favorite diagnosis in chronic appendicitis of infancy is chronic enteritis, in many such cases the appendix being solely to blame.

Under the name appendicitis larvata, Ewald described a form of appendicitis in which the physician judging from the syndrome is inclined to diagnose almost any condition rather than chronic appendicitis. Patients thus afflicted complain of diffuse vague stomach and intestinal symptoms, acid eructations anorexia disagreeable sensations on taking food, obstipation with tenesmus and pain. In men the condition is often ascribed to stomach and intestinal catarrh in women to hysteria etc. but patient observation and repeated examination bring proof that at the bottom of the syndrome lies a chronic appendicitis.

For the present it will surely be safer for us of the common run to cling to the belief that the chronic appendicitis syndrome—nausea vomiting eructations, hard right rectus muscle tenderness at McBurney's point meteorism at the cecum (the balloon symptom) Rovsing's gas pressure pain, sex gland pain weakening of the cremaster reflex funicular pain on coughing and on introduction of the examining finger into the right inguinal canal and on deep right rectal and vaginal pressure—all these things mean chronic appendicitis and demand removal of the appendix notwithstanding the contrary view of the brilliant internist epigrammatist.

The most cogent reason for not temporizing in such cases awaiting a clear cut acute attack, is that it is very difficult to determine just what pathology underlies the symptom group reviewed above. My own experience is not an unusual one neither its volume nor its fiber being remarkable in any way and yet it has brought out many cases of clinically

quiescent appendicitis with no history of an acute attack in which operation revealed a truly dreadful inflammatory condition in and about the appendix. In a recent instance a young man giving no history of acute illness pertaining to his abdomen and presenting only the common signs of chronic appendicitis, was found upon operation to have an appendix thicker than one's thumb and 5 inches long lodged in a bed of tough adhesions situated retrocaecally and subhepatically. This is a common finding a retrocaecal appendix tied down in a mass perityphilitis adhesions as described long ago by Virchow. Here we find not infrequently what Dr. Percy of San Diego would designate as a God awful state of affairs and yet expressing only the mild symptoms of a classical chronic appendicitis symptoms which the pacifists of abdominal therapy are adjuring us to ignore.

I have operated upon a boy for general purulent peritonitis who ploughed the day before and a girl for the same condition who had prepared dinner for a harvest crew the day previous to her operation. Did this serious pathology develop overnight or was it wholly or in part present the day before operation when the patients seemed well? It is much more reasonable to assume that there was a chronic appendicitis present days or weeks or months before the frankly acute attack and without symptoms. Patients with purulent appendicitis have walked into my consulting room more than once. It is difficult to determine the nature and severity of appendiceal infection without operation. Here surely the first aphorism of Hypocrites. Judgment is uncertain and experience fallacious must be set aside if we accept the view of those who call chronic appendicitis a myth and discountenance operation therefore.

Is chronic appendicitis a myth? Few indeed will subscribe to the statement that chronic appendicitis does not exist at all. The element of danger lies in the contention that chronic appendicitis is very rare that it is a non-surgical condition that normal appendices are being removed by every surgeon everywhere in great numbers. If one were to depend for justification upon microscopic pathological findings alone then

truly in many cases normal appendices are removed by capable conscientious surgeons without justification. However such surgeons need not and do not depend alone upon the pathologist who cross sections the appendix for their justification for they have too often seen the whole right half of the abdomen especially the region of the terminal ileum and caecum filled with adhesions fettering and deforming the appendix and producing traction upon its mesentery. They have seen the deep congestion of all of the branches of the ileocolic artery and vein and they have seen and appreciated the appendix in its relation to colitis and stasis in cases in which the appendix because of an adhesion to its peritoneal surface deforming its lumen has ceased to drain and has become a veritable culture tube of the devil fabricating toxins which in the colon excite colitis, pericolitis, adhesions stasis etc.

In other words a conscientious surgeon can readily admit that with a proper sense of his duty he may be ready to excise an appendix in which the pathologist sectioning its walls can find nothing abnormal because the symptom producing lesions are extraneous to the walls of the appendix except perhaps for a small peritoneal tag the result of the separation of an adhesion on the peritoneal coat which though it might have caused deformity and interfered with drainage need not of necessity have caused characteristic coil changes in the appendix wall.

Even slight adhesions of the appendix may as is well known give rise to disturbances in structures remote from the ileocaecal region. Adhesions at the appendix causing constriction and fixation of the intestine lead to mechanical distortion with stasis and colitis and by establishing abnormal functional conditions give rise to aberration in the behavior of many parts of the gastro-intestinal tract through the agency of reflex action. Thus in some instances as Hecox has explained spasm of abnormality of peristalsis of portions of the gut stasis of faecal contents or gas may occur in portions of the gut far removed from the actual seat of the lesion without the finding of any anatomical variation in the portion where the function is disturbed for example dis-



turbances of the stomach with imperfect emptying of contents may occur in cases in which no distortion of the stomach or duodenum is present and in which the only anatomical abnormality found is an adhesion of the appendix to the cecum with stasis of the latter.

In this same manner the contralateral pain not rarely associated with chronic appendicitis may be explained without yielding ground to those who would have us abandon our studies of chronic appendicitis as misdirected and futile.

Anthony Bandler (4) reports a case of chronic appendicitis simulating angina pectoris. Cases of chronic appendicitis diagnosed as disturbance in the gall bladder, gastroduodenal ulcer and various functional gastric disturbances are well known, operation usually disclosing the misdiagnosis, generally with relief to the patient from the operation.

The patient of Bandler a stock broker, aged 50 came under observation, Jan. 7, 1922. His father died of heart disease, his mother of apoplexy. His past history was negative. He had been constipated most of his adult life, excepting on occasions, so he thought it was due to nervousness from active business strain. One night in early November, 1921, he suddenly awakened with an intense pain in the lower abdomen, followed by a temperature of 101, nausea, and vomiting. The illness lasted 4 days, and was treated by rest in bed and colon irrigations, the latter being continued for months. About a week after the onset of this illness he began to have burning sensation in the chest. This was independent of meals or other noticeable cause, and gradually intensified and deepened into distinct pain. The attacks of burning and pain would come on suddenly continue for varying lengths of time and stop quickly. Various measures of treatment were employed without benefit. The attacks were always brought on by exertion, at first not marked, but in a few weeks so severe that he was unable to walk from his home to his office about 700 yards, without severe attacks. Three physicians said he had angina pectoris.

The appendix, as removed by Dr. Charles Peck, and the patient made a smooth recovery. Microscopic examination showed the usual findings of chronically diseased organ with subacute addition. After leaving the bed some slight attacks of burning sensations and slight pain in the chest occurred on exertion, these lasting (gradually getting less) for about 3 months. A year has now transpired since the last of these, and the man has been uninterrupted well. On many occasions he has tried by vigorous exercise (ice skating, swimming, etc.)

long walks, laborious work on his farm) to test himself and he has experienced no recurrence of the chest symptoms.

In the intimate relation of chronic appendicitis to colon stasis may be found a probable cause of some of the uncertainty as to the important rôle of the former in pathology and clinical medicine and surgery. Assuming that the effluent toxins of a chronic appendicitis may and do in fact produce a low grade colitis and an almost necessarily consequent pericolicitis with adhesions, one can readily understand why the sites of most pronounced pericolicitis and stasis should exist at the four sharp turns of the large intestine, the cecum, hepatic and splenic angles and the sigmoid. Is it not possible that the inevitable tenderness and ballooning at the three last turns of the large intestine have caused many to deflect their attention from the real malefactor, the appendix and the other ileocecal structures?

It has been observed that this area is almost invariably the site of more or less peritoneal inflammation with a notable tendency to the formation of membraniform adhesions. Such membranous adhesions are very common in apparently healthy dogs. The vermiform appendix in the dog, as is well known, is very large, being virtually an elongation of the cecum. This abnormally large appendix is usually found to be tightly filled, likewise the ascending and transverse colons are more or less engorged at nearly all times in the healthy dog. Manifold membranous adhesions bind the appendix to the terminal ileum or to the ascending colon. In several of the author's specimens the appendix was sharply angulated at two or three levels by contracting membranes or bands. Often the terminal ileum was found to be enveloped in such membranous adhesions. On microscopic examination of the colon wall opposite these adhesions, complete evidence of chronic colitis was found in each case. The goblet cells and the lumina of tubules were engorged with mucus. The inter-tubular spaces were infiltrated with round cells and Maxmow polyblasts were seen in nearly every field. The small blood vessels were congested.

Colon stasis in the dog is almost constant. Thus it appears that the factors mentioned

before, chronic appendicitis adhesions membranes and kinks at the cecum, colitis and stasis are to be observed in nearly every dog. What is the relation between the appendicitis and the stasis?

A great many writers, including Virchow Gerster and Pilcher have expressed the belief that plastic adhesions may form about the colon as the result of a toxemia having its origin within the lumen of the large intestine. In view of these things it does not seem illogical to say that membranous adhesions about the colon may result from stasis due to chronic appendicitis. I have been impressed by the frequent incidence of a delicate vascular form of pericolic membrane about the terminal ileum and cecum. It may be found in some form or degree about the cecum in nearly every case of chronic appendicitis. That is, a thin vascular extra peritoneum may be slipped over the underlying serosa in nearly every case of chronic inflammation of the veriform appendix. On microscopic examination this membrane closely resembles the peritoneum of the omentum, and the blood vessels are clearly simply enlarged branches of the ileocolic and artery vein. Thus it represents the congestion zone of an inflammation, the center of which may always be suspected to be and often proven to be in the appendix.

As is well known, a common site of congenital deforming, defunctionalizing adhesions is about the cecum. Up to the fourth month of embryonic life, this, like other parts of the large intestine hangs by an ample mesocolon. Subsequently however this mobility becomes lost, owing to the fusion between the outer lamina of the mesocolon and the neighboring mural peritoneum. It should be noted that this fusion takes place in varying degrees. Thus we can account for many irregularities in the attachments of the cecum and ascending colon. After normal fusion, the mural serosa becomes continuous with the tunica serosa of the ascending colon. The fused layers behind the colon disappear as such, and the posterior wall of the latter no longer has a peritoneal covering.

Instances of retrocecal and retroperitoneal appendix may be explained rationally by assuming that before fusion occurs the appendix

becomes caught between the coalescing peritoneal surfaces of the cecal mesentery and the abdominal wall. In caecal descent and torsion the appendix might readily be arrested at an abnormally high position and between the serous surfaces mentioned. In this manner a true congenital retroperitoneal position of the appendix may be developed which is obviously different from that condition in which, after fusion as described above, has occurred the appendix is buried under a membrane made by adhesions of small folds about the ileocecal region to the mural serosa which adhesions are drawn out as membranes over the caput coli and appendix during normal caecal torsion. Such a lodgment of the appendix may clearly lead to serious and intractible disturbances of colon function and moreover sectioning would perhaps reveal little or no pathology in the walls of the appendix itself.

It has been contended by some surgeons that the removal of the appendix occasionally brings about a cure of such remote conditions as duodenal and gastric ulcer and it has been suggested that duodenal ulcer and allied conditions are produced by an infection of organisms which grow in the appendix.

While the fact is perhaps established as stated by Mr. Lane that the removal of the appendix is occasionally followed by the disappearance of duodenal ulcer and allied conditions, the foregoing explanation of the phenomenon is, as he states, probably incorrect. It is more rational to believe that the ulcer or as more definitely proven other secondary conditions get well because the appendix which was removed had controlled the effluent in the ileum, and the freeing of this ileal effluent has of necessity relieved the results of its obstruction, of which the duodenal ulcer was one and only one.

The problem of ileal obstruction, either by an ileal kink or by the pressure of an appendix secured to the back of the mesentery or by both sharing in the production of obstruction of the ileal effluent, is still to be regarded as one of some importance. The cecum and ileal loop are both distended with fecal contents and fall into the true pelvis. The end of the ileum hangs over and its lumen is diminished by the fixed portion of the appendix

secured by its mesentery. It is apparent as noted by Lane that the greater the drop of the cæcum as it pivots on the fixed appendix and the greater the dropping and distention of the ileum, the more complete does the obstruction by the appendix become. A pertinent matter of interest here being that the appendix causing all of this trouble would perhaps not show any signs of inflammation on microscopic examination.

It may be said that the condition described above cannot fairly be classified under the head of chronic appendicitis; nevertheless they are nearly always surgical conditions and are practically always associated with chronic appendicitis and are often its sequelæ. Comparing to bring about the crisis of an acute attack but it is of paramount importance that these associated conditions are very often relieved by removal of the appendix if removed early enough that is before the pain habit, vagotonia, neurasthenia etc. are firmly established.

If a question is raised as to whether one is ever justified in making a diagnosis of chronic appendicitis in the absence of a history of acute attacks the question surely must be answered in the affirmative. How often does one find the appendix serving as the tie which secures the cæcum in an abnormal position, with dysfunction and chronic pain in cases giving no history of an acute attack.

No doubt much of the confusion in interpreting pathology in and about the appendix is owing to faulty nomenclature. If we should think and speak, often of the misplaced adherent and strangulated appendix and less frequently of active inflammation no doubt a better understanding would develop. The common denominator so to speak is perhaps to be sought in more accurate terminology.

Naturally sensible surgery in chronic appendicitis presupposes intelligent diagnosis and careful exclusion of pyelitis, kidney or ureteral tone, tuberculous infections of the reproductive organ, neoplasm etc. but in making such a differential diagnosis it is surely unwise to attach too much value to the view held by some that in lower right sided pain the appendix as a crucial factor stands very low in point of frequency. Since the appendix can give rise to a serious train of abdominal symptoms through malposition, adhesions, etc. without being itself actually the seat of inflammation. After all the surgeon to be trusted fairly and intelligently to deal with this problem is the one who operates with the support of a carefully made diagnosis. In no field of surgery is the French proverb more applicable: *Le bon œpe s'en sertait quel-wels un mauvais chirurgien*.

Cautious surgeons will continue to find after thorough differential diagnosis that chronic appendicitis is a rather common condition. Some years ago Dr. William Mayo was asked how it happened that at his clinic there were found among cases of upper abdominal pathology so high a proportion of gastric and duodenal ulcers. His answer was characteristic, practical and instructive. He said: "We diagnose them." Whereas the unscrupulous may continue to remove the appendix needlessly the discerning will it is hoped continue to diagnose correctly and prevent calamity by early operation in chronic appendicitis.

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## A PRELIMINARY REPORT ON ARTERIAL SYMPATHECTOMY

INCLUDING A REPORT OF TWO CASES<sup>1</sup>

BY E. A. CAMPBELL, M.D. NEW YORK

Professor of Operative Surgery and Chief of Clinic, New York Post Graduate Medical School and Hospital, Associate Attending Surgeon, City Hospital

OUR efforts on the service of Dr. Parker Syme at City Hospital to add to the limited data available on arterial sympathectomy were stimulated by the essay of Dr. Walter Sherwood before the New York Surgical Society on March 28, 1923. The meagerness of our progress in the treatment of many diseases frequently makes us reach out and grasp the straws of possibility in the hope that they may develop into a firmer element of support.

Diseases assigned to disturbance of the nervous control of blood vessels have ever been baffling. In 1920 Leriche reported marked improvement in a case of trophic ulcers of the legs after the performance of a procedure devised and called by him periarterial sympathectomy which he performed upon both femoral arteries.

In 1921 he made a consolidated report of 64 cases in which he performed sympathectomies for various diseases with only one complete failure. Various other reported cases come to us from the clinics of Bruning and Forster Veillet, and Jianu. Dr. Sherwood's cases are comprehensive additions to the statistics.

Nerve impulse is carried by efferent nerves to spinal or cerebral centers, there to be transmitted to the terminals of that nerve, for action. As demonstrated by MacKenzie, Cannon, and others, irritation of a nerve in any part of its efferent or afferent course causes an exaggeration of the normal function of that nerve at its efferent terminals. For example, disturbance of a nerve center produces exaggeration of function at its terminals and irritation at the periphery is transmitted to its center and through afferent branches produces the same exaggerated function.

The nerve supply of the blood vessels is obtained from the autonomic or sympathetic system, the filaments of which enter the adventitia of the vessel are disseminated in a network in this layer and give off innumerable

branches perforating into the muscular layers. No nerves are demonstrated where no muscular layer exists. The action of these nerves consists in stimulation of the muscular coat to contraction thus decreasing the lumen of the vessel and therefore the volume of the blood transmitted to its terminus.

The experiments of Cannon seem to demonstrate that vasodilatation *per se* is very weakly if at all under direct nervous control but is accomplished largely by inhibition of vasoconstrictor nerves.

Causative factor is fairly constant in its physical effect. The continued irritation or irritability of vasomotor nerves, peripherally centrally or along the course of its fibers will cause a vasoconstriction and insufficient blood supply eventuating in terminal death of the part. In the accomplishment of this the motor terminals become involved and transmit a painful sensation.

Any or all of these elements have been conjecturally assigned as the causative elements in Raynaud's disease, trophic ulceration of the extremities, some types of arteriosclerosis, frost bite and similar conditions.

With these points in mind Leriche contended that, if the continuity of nerve supply to an artery was broken, the effect of the irritation (vasoconstriction) by any afferent or efferent part of that nerve would be destroyed. He therefore advised the removal of a portion of the adventitia of the main artery leading to the affected part.

The procedure is simple of performance. In the two cases to be quoted, an incision 15 centimeters in length was made beginning about 5 centimeters below Poupert's ligament downward in the direction of the femoral artery. The fascia of Hunter's canal was broken through and the artery freed from its surrounding attachments. The adventitia was incised transversely below the profunda and circumflex branches. A second incision

through the adventitia was carried downward in the long axis of the vessel for a distance of about 10 centimeters. The adventitia then stripped easily from the vessel. Some small branches were torn away and were closed by a single inverting stitch of silk. The vessel was wiped clear of any adherent portions of the adventitia.

The first effect observed was a constriction of the vessel to about one-half its normal caliber in the denuded portion. This agrees with the statement made by Leriche who affirms that this constriction is followed in a few hours by dilatation lasting about 4 to 6 weeks.

Our attempt on the first artery was made more tedious by fear of entering the artery and in trying to wipe away instead of incising the adventitia. With the institution of the improved technique, its accomplishment was materially simplified.

An abbreviated report of our two cases is as follows:

**CASE.** Female, white, age 58 admitted to City Hospital, March 29, 1923. She complained chiefly of intense pain in the lower extremities for the past 9 days increasing in intensity and accompanied by numbness of the toes. She has had pain and soreness in both feet for the past few years. Examination showed edema of the lower extremities. Both feet were swollen below the ankles. Both feet showed erythema on dorsal and plantar surfaces. All of the toes were almost black, with several large blebs on the plantar surfaces. The feet were very cold. Wassermann was negative. Blood report: urea nitrogen, 3 sugar 4 creatininel, 3. Electric light treatment instituted and continued for 6 days without relief. During this time toes became entirely gangrenous and blebs spread to dorsum of foot covering area of centimeters by 7 centimeters. On April 1, 1923, bilateral femoral sympathectomy as performed. Day following operation patient reported no pain in feet but some pain in legs. Ten days after operation sharp line of demarcation appeared in gangrenous area, blebs entirely disappeared pain in legs diminished. Fifteen days after operation patient complained of small amount of pain in feet. Sixteen days after operation both feet were amputated. The muscular tissue was grayish and unhealthy in appearance. The stumps broke down but showed no evidence of returning gangrene. At the present time, the patient complains of some pain in the stumps but less severe than before sympathectomy was performed.

**CASE.** Female, white, age 5, admitted to City Hospital, March 2, 1923 complaining of great pain

in both legs. History of onset 6 years ago after a severe attack of influenza, which was followed by intense pain in the great toe of left foot. The toe became swollen and red and was amputated shortly thereafter. Four years later two toes of left foot and great toe of right foot showed the same changes. These toes were amputated. The wounds did not heal. The pain became very severe, particularly at night. Ten days after admission to City Hospital the middle toe of right foot was amputated. Wassermann was negative. Blood chemistry was negative. A bilateral femoral sympathectomy was performed April 1, 1923. The day following operation the patient reported no relief from pain. Marked diarrhoea. Four days after operation patient reported some relief from pain. Eight days after operation patient reported no pain. Ten days after operation patient reported no pain.

This patient had become addicted to morphine for the relief of pain. Its removal undoubtedly was the cause of an intractable diarrhoea. The occasional administration of morphine in small doses seemed necessary. Attacks of this complication are still recurrent.

Since all other types of treatment in these conditions have been of little value, such a simple surgical procedure is justifiable. Any thing that will relieve the symptomatology if not the pathology is worthy of extended trial. These two cases are far from satisfactory. We are not overly enthusiastic as to the results, but are willing and anxious to continue research along this line and largely with the view of increasing the statistical evidence and stimulating further investigation we are making this presentation.

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EXPERIENCE WITH ONE THOUSAND CASES OF ABORTION<sup>1</sup>

BY DAVID S. HILLIS, M.D., I.A.C.S. CHICAGO

THE only adequate method of comparison between the result of the modes of treatment in abortion consists in comparing large series of cases treated actively and conservatively. This paper represents the study of a thousand consecutive abortion cases admitted to the obstetrical service of the Cook County Hospital between July 1, 1920 and March 27, 1923. Through the courtesy of my colleagues in the obstetrical department I have been privileged to direct the management of these cases.

A general policy of conservatism was carried out. This policy was based on a previous study of 322 cases of septic and non septic abortion, reported in 1920 in *SURGICAL GYNECOLOGY AND OBSTETRICS*.

The present series was conducted in such a manner as to secure, if possible, information with reference to the points on which there is a difference of opinion in regard to treatment, namely:

1. The relative value of active or operative and conservative or non operative therapy as applied (a) to febrile and (b) to afebrile cases.
2. The effectiveness of a five day period of normal temperature elapsing between the last day of fever and a curettage in febrile patients.
3. The effectiveness of a five-day period of normal temperature elapsing between the day of admission and a curettage in afebrile patients.
4. The frequency of bleeding severe enough to threaten life in abortions under three months.

All cases were alternatively assigned to two general groups upon admission—an active group and a conservative group. They were treated according to the class into which they fell on a basis of diagnosis: (1) threatened abortion, (2) inevitable abortion, (3) cases with normal temperature, (4) cases with a temperature of 100 degrees or above, and (5) cases with serious hemorrhage.

Patients with threatened abortion were treated with rest, sedatives and ice bags to lower abdomen.

Inevitable abortions with normal temperature assigned to the active list were curetted on the fifth day after admission if there was any reason for so doing provided the temperature remained normal. The reason for this five-day period was that all the patients were considered potentially septic, inasmuch as there was no way of knowing whether or not they had had fever previous to admission. Further the five-day period of delay was based on the following observations. In 100 of 200 cases of septic abortion observed between the years 1911 and 1916 the uterus was emptied artificially during the febrile period and as soon as convenient after admission. In the other 100 cases there was no local treatment. The conservatively treated cases had fewer days of fever, a shorter stay in the hospital, fewer complications and a lower mortality.<sup>2</sup> In the period from October 1918 to April 1919 a three-day period was tried. In not a few cases there was an alarming postoperative rise in temperature and the stay in the hospital was prolonged.

In the present series if the patients with inevitable abortion fell on the conservative list, they were not curetted unless bleeding threatened life or bloody discharge persisted more than 10 days. No patient with a temperature of 100 degrees or above was curetted unless hemorrhage threatened life. If such cases were assigned to the active list and bleeding indicated that the uterus was not emptied they were curetted after the temperature had reached normal and then remained afebrile for 5 days. If they fell on the conservative list they were only curetted if bleeding persisted more than 10 days and the temperature had remained normal. If hemorrhage occurred severe enough to endanger the patient's life, the uterus was emptied regardless of temperature and in such a man-

<sup>1</sup>Treatment of abortion. *Surg. Gynec. & Obst.* 32:20, 1921, 405.  
<sup>2</sup>Read before the Chicago Gynecological Society, June 15, 1923. (*Proc. December, 1923*, p. 121.)

TABLE I—PARITY

Parity												
	0	1	2	3	4	5	6	7	8	9	10	Total
Active lot	89	90	77	23	15	27	27	1	2	1	1	290
Conservative lot	98	103	5	64	47		30	30	14			290
Total (No undetermined)	187	193	82	87	62	57	57	2	16	1	1	580

TABLE II—PERIOD OF GESTATION

Month of Pregnancy							
	1-2	3-4	5-6	7-8	9-10	11-12	Total
Active lot	194	160		26	5	1	276
Conservative lot	143	37		47	34		251
Total (No undetermined)	337	197	14	73	39	1	651

TABLE III—ETIOLOGY OF ABORTION

	Spontaneous	Criminal or self-induced	Trauma or accident	Total
Active lot	269	84	6	359
Conservative lot	254	300		554
Total	523	384	6	913

N. B. Of the total number of cases were noted 21 septate uteri of various degrees, two pyroelectric, one fibroid uterus, one double vagina and cervix.

ner as to cause the least possible traumatism to the uterus and surrounding tissues. When emptying the uterus in the presence of fever the use of the curette was avoided if possible. Ovum forceps were used to remove the placental fragments which were often found protruding through the soft dilated cervix. Cases with dangerous hemorrhage are rare in which the cervix is not sufficiently dilated to admit the ovum forceps. Curettage in afebrile cases was done with the finger ovum forceps or curette depending upon the cervical dilatation present.

Rectal examination was done as routine in all cases.

The parity of the cases is indicated by Table I. The distribution is quite wide and no definite conclusions can be drawn from these figures even though abortion seems to be more frequent in women who have borne no children and in primiparae.

Abortion was more common in 633 of 918 patients between the first and third months of gestation (Table II).

Table III shows that of a thousand cases, 224 or 22 per cent, were criminal or self-

induced. In 763 or 76 per cent the abortion was apparently spontaneous and in 55 or 5 per cent there was recognized pelvic pathology. The importance of these figures with reference to septic abortion is brought home to us when we recognize that it is clear that a febrile abortion caused by criminal attempts to expel the fetus is something entirely different from the clinical standpoint from a febrile abortion resulting from the retention of placental remains or a macerated fetus.

There were 744 incomplete abortions (77.2 per cent) as shown in Table IV.

Table V shows 297 cases of the series admitted with a temperature above 100 F. 29.7 per cent.

The average days of temperature for curetted and non curetted patients was slightly

TABLE IV—TYPE OF ABORTION

	Complete	Incomplete	Threatened	Total
Active lot	67	28	30	125
Conservative lot	1	241	28	270
Total	68	269	58	395
Percentages	17	68	15	

TABLE V—TEMPERATURE ON ADMISSION

	T of 97°	of 98 to 100°	and 1° or above	Total
Active list	29	84	16	229
Conservative list	27	79	21	227
Total	56	163	37	241
Percentage	23.2	67.2	15.2	

TABLE VI—TOTAL DAYS OF TEMPERATURE

	Number of cases	Total days of temp.	Average days before operation	Average days after operation	Average days
Curetting	24	249	10.4	1.8	6
Non-curetting	227	246	1.1		
Total	251	495	6.6	1.8	6

TABLE VII—EFFECT OF CURETTAGE ON TEMPERATURE (241 CASES)

Cases with fever before operation	A	B	C	Cases with fever before operation	A	B	C
Number		29	7		54	29	79
Number continuing or developing fever after operation		23	30		3	6	6
Percentage	77.4	79.3			5.6	21	7.6
Total number days	16	75	101		3	7	5
Average number days		2.6	14.4		1.5	2.3	6.4
Number in which fever stopped after curettage	1	26		Cases in which no fever developed	3	4	71
Percentage		89.7	100		5.6	13.8	89.4

Column A represents patients cured before they were in the hospital 5 days

Column B represents patients cured after five-day rest period

Column C represents all cured patients

longer for the latter—1 71 days in contrast to 1 53 days for the curetted (Table VI). It is to be recalled that the curetted patients include those on the active and conservative lists, who had alarming hemorrhage or who were not complete abortions after the five or ten-day period previously described. Further of the patients who had to be curetted the average febrile period before operation was 0 92 day and but 0 60 day after operation. Considering the entire series of a thousand cases it seems safe to conclude that curettage did not lengthen the average total febrile period. A more detailed analysis of the effect of curettage on temperature appears in Table VII.

Of a total of 241 curetted patients 71 (29 4 per cent) had fever before operation, and 170 (70 5 per cent) were afebrile. Twelve of the febrile and fifty of the afebrile patients or a total of 62 (25 7 per cent) had such alarming hemorrhage that curettage was carried out before the end of the five-day period. In both instances where the five-day period could not be observed the percentage developing or continuing fever after operation (febrile group 58 3 per cent and afebrile group 26 per cent) was considerably higher than the per-

centage who had the advantage of a five-day rest period (febrile group 38 9 per cent and afebrile group 5 per cent). However it is interesting to note that the afebrile patients who had the five-day rest period had a greater average number of days of fever (4 5 days) after operation than those who were operated on before the five-day limit (1 38 days). Of the afebrile group, 4 per cent of the emergency curettage patients remained fever free while 95 per cent of those with a five-day rest period remained afebrile.

Table VIII indicates that when the patients were safely curetted the average days of redlochia were 1 48 days after the curettage. Among the non-curetted cases the average days of redlochia were 3 9 days.

The number of days in the hospital was shorter among the non-curetted cases but 179 of 241 curetted patients were kept at least 5 days before being operated upon. Had this rest period been eliminated, the duration of stay in the hospital would have been shorter for the curetted patients.

Table X indicates the type of treatment carried out in the series and is self-explanatory.

The gross mortality of the series was 2 per cent (20 of 1000). There were 297 cases ad-



TABLE VIII—LOCINA NUTRA

	Corrected	% of correct
Number	41	779
Total days	54	2960
Average days	7	130
Days after operation		
Days after operation		

TABLE IX—DAYS IN HOSPITAL

	Current	next
Number		17
T (all days)		
Average	10	10

TABLE 3.—TYPE OF TREATMENT

[illegible]

TABLE XI—MORTALITY

	Controlled Group	Controlled Group T10
Female		
Percentage correct	34	34

mitted with a temperature of 100 or above. Twenty of these died. No patient died among those admitted with a temperature below 100. There were 12 female patients cured with three deaths and 229 aseptic patients cured with no mortality. Of the 20 fatal cases, 14 showed unmistakable signs of extension of the infection beyond the uterus at the time of entrance. Nine had a general peritonitis, one a local peritonitis, three a septicæmia and one a pneumonia. In these cases the abortion itself had become of secondary importance and the treatment concerned principally the treatment of the well defined complications resulting from the abortion. In considering the results of a given plan of treatment of abortion, these cases might properly be excluded. Of the remaining 6 cases, the uterus was emptied in the hospital in 3 on account of hæmorrhage (2 of these

were criminal abortions) 1 was curetted before entrance 2 were not curetted in the hospital and denied interference before admission. In only one case among those who died was it known that the patient was not subjected to some kind of intra uterine manipulation either outside or in the hospital. Sixteen of the 20 fatal cases were known to have been criminal abortions induced by a physician, midwife or by the patient herself. The two cases which died and were treated expectantly denied interference and no evidence to the contrary was found. One case undoubtedly could give no history and doubtful evidence of abortion was found postmortem.

Only three deaths occurred among patients in which the abortion may have been of spontaneous origin. In only one fatal case was the abortion known not to have been criminally induced. This patient died 5 days following an extensive operation for ventral hernia and one day after the curettage. This death was due to hemorrhage and shock and not to sepsis.

Most of the deaths were in patients who were admitted in such a condition that it was evident the septic process had extended widely beyond the uterus and were therefore not cured. For this reason the percentage mortality is 1 per cent greater in the cases with no local treatment. These figures in themselves on their face would seem to indicate that active treatment furnishes the best prognosis from every standpoint. Such a conclusion is seen to be false when the list of fatal cases is studied 16 of which were criminal abortions.

## CONCLUSIONS

The study of a thousand cases of abortion seems to indicate that—

1. Conservative treatment of abortion in febrile cases gives better results than active therapy.

2. Febrile patients who have a five-day afebrile period have a greater tendency to continue a normal temperature after curettage than those who are operated upon before the end of this period.

3 Afebrile patients with a five-day observation period have a greater tendency to

remain with a normal temperature than do those who are curetted before the end of this rest period

4 Approximately 62 per cent of patients must be emptied because of alarming hæmorrhage

5 A plan of procedure which embodies a conservative rest period of 5 days normal temperature for febrile and afebrile patients and results in as low a mortality as quoted in this paper seems to be a rational method for the treatment of abortion

## CYSTIN NEPHROLITHIASIS

REPORT OF CASE WITH ROENTGENOGRAPHIC DEMONSTRATION OF DISSOLUTION OF STONE BY ALKALINIZATION

B. A. J. CROWELL, MD, F.A.C.S., CHARLOTTE, N. C. CAROLINA

CYSTIN nephrolithiasis is a rare but a very interesting condition. It is especially interesting first because of the uncertainty of its etiology, second because of the probable infrequent recognition of the disease, and third because of the excellent results which may be obtained by proper diet and internal medication. The disease has been known for more than one hundred years. It was first thought to be due to anomalous metabolism similar to that occurring in gout and diabetes. Link was able in 1912 to collect from the literature only 146 cases. To our knowledge we have had only one case at our Clinic. We probably have had others but did not recognize the condition.

A great many theories have been presented and considerable laboratory work done in connection with clinical observations in order to arrive at a satisfactory explanation of cystinuria, but thus far we are far from it. One of the earliest beliefs was that there was an abnormal catabolism of protein in the intestinal tract with a consequent production of cystin so much in excess that it could not be disposed of and was excreted unchanged in the urine. Blum disposed of this theory by his experimental proof that large amounts of cystin when given by the mouth even to the limit of toxicity could be oxidized in the body without the production of cystinuria.

Thiele found that the amount of cystin excreted was practically independent of the diet. The patient was able to break up cystin

administered by the mouth even though it was cystin previously excreted by him.

The modern view of the production of cystin in the body is that it is due to some error in metabolism. This error involves some of the end decomposition products of protein of which cystin is the most important. The oxidation of some of the other amino-acids and the diamines may also be inhibited. There is a varying extent of error as regards the number of protein fractions involved.

Alsburg and Folm, as a result of their study of the subject, believe that the cystin excreted is proportionate to the protein intake. Reduction of protein intake reduces the amount of cystin in the urine but does not get rid of it altogether. Their observations lead them to believe that alkali does not act as a solvent but influence metabolism so that cystin is not formed and excreted as such.

Stadthagen and Brieger believe it an infection. The frequent coincidence of cystinuria and constipation would favor this theory. Wasserkthal pointed out that the frequent coincidence of articular rheumatism and cystinuria was significant for this theory.

Moreigne concluded that cystinuria is a condition of nutrition caused by partial arrest of oxidation. He says the infectious theory is not comparable with the fact that cystinuria lasts for a life time.

Ackerman and Kutscher state that it is a generally accepted fact now that the cause of cystinuria is a suppression of amino-acid catabolism.



FIG. (at left) Roentgenogram showing 3 stones in left kidney pelvis and one in the right. January 3, 1912.  
Fig. Right ureteropyelogram showing 2 stones. Solution covers stone. January 4, 1912.

Wolfe and Shaffer say that cystin in high protein feeding is largely of exogenous origin but a part is probably not derived from food protein. To what extent strictly endogenous processes play a part in its formation is impossible to say.

#### DIAGNOSIS

The presence of a stone in the bladder or a shadow in the kidney associated with cystin crystals in the urine or its presence in solution in the urine suggests the diagnosis of cystin nephrolithiasis. Absence of cystin from the urine chemically or microscopically does not mean that the stones are not cystin. It occasionally disappears from the urine temporarily. Many observers believe it will return regardless of treatment. Some think it is impossible to free the urine entirely from it. Albarg and Folin hold to this theory. Bloody urine associated with pain in the back may mean cystinuria even though there be no shadows in the kidney region. The question can be cleared up by urinalysis. Many cases of kidney colic and back pains may be produced by the passage of cystin crystals.

#### PROGNOSIS

The prognosis of cystin nephrolithiasis is considered good as to life but not good with

respect to cure. Recurrence of cystin stone following nephrolithotomy has been considered almost certain but our experience with the condition leads us to believe that we may not only prevent recurrence but also bring about disintegration by proper management and treatment. When these stones do form the usual sequelae of stone-formation follow, the resulting pathology being dependent upon the location and size of the stones.

Before taking up the treatment of this condition I wish to report the following case which came under our care January 1, 1912.

CASE \ 617 female, age 37 single. The parents are living and in good health. Paternal grandfather had kidney colic when young man but lived to be over 80 years of age. One paternal aunt died of kidney trouble. One sister 37 years of age had right nephrectomy performed 4 years ago on account of large stone and infected kidney. She now has 2 stones in the left kidney. With these exceptions the family history is negative and the members are generally long lived.

Patient has suffered more or less all her life with some frequency of urination and pain in the back. She passed what she termed a "shower of stones" — so 1/2 5—1a 913 but never suffered with colic until days previous to coming under our care. A large stone was removed from the right kidney by Dr. Shipley of Baltimore, June, 1911. At this time the roentgenographs showed 1 small and one large stone in the left kidney. These were removed by py-



Fig 3 March 9, 92



Fig 4 May 4, 9



Fig 5 Stones slightly reduced in size April 7 922

clotomy November 24, 1921. At the time of this second operation, the roentgenographic examination revealed a recurrence of stone in the right kidney pelvis. Dr Shipley writes me that these stones were analyzed in the University Laboratory and found to be composed of cystin. Chemical analysis of the urine also showed the presence of cystin.

**Present illness.** The patient came to our Clinic, January 1, 19. She had been suffering with nephritic colic for 3 days and was brought in on a stretcher. Her temperature was 103 degrees F, pulse 130, tongue dry and patient was very toxic. In fact, she was in a semi comatous condition and in every respect she appeared to be a very sick woman. Cystoscopy showed the left ureteral opening normal in appearance and functioning regularly. A large stone was seen in the right uretero-vesical opening. An effort was made to dislodge it with the beak of the cystoscope. Failing in this, a No. 9 ureteral catheter was finally passed by the stone and an abundance of pus obtained. The catheter was fastened in and retained for 36 hours, during which time the pelvis was lavaged every 3 hours with saline solution. The temperature rapidly dropped, the extremely parched tongue became moist, the delirium disappeared, and the patient was much more comfortable in a very short time. As a result of ureteral dilatation the large stone observed in the ureteral opening was voided within 12 hours after the retention catheter was removed. This was analyzed and found to consist entirely of cystin.

Fifteen days later the phenolsulphonethylphthalein, after intra venous injection, appeared in the urine from the right kidney in 3 minutes and the output in 5 minutes was 5.25 per cent with a concentration of 10 per cent of each milliliter. The phthalein appeared in 3 minutes from the left and the output in 15 minutes was 5.5 per cent or 38 per cent to each milliliter of urine, thus showing the function better on the left side. Thus, in connection with a few granular tube casts and a trace of albumin,

would indicate a pyelonephritis. Roentgenogram showed a large stone in the right kidney and 3 smaller ones in the left. Leucocyte count was 12,050. Wassermann reaction was negative. Pelvic lavage with mercurochrome and saline solution was given every second and third day for about 45 days. During this time her urine was kept alkaline by taking sodium bicarbonate. The infection gradually disappeared and the kidney function improved. She went home with instructions to keep her urine alkaline by taking bicarbonate of soda and report weekly for pelvic lavage. The stones shortly began to reduce in size and continued until they disappeared entirely from the kidneys 9 months thereafter. In addition to the disintegration of the stones the infection cleared up and the urine is free from cystin. The patient is now 35 pounds heavier than when she first came under our care.

In our case the kidneys have been freed from stones and the urine from cystin by keeping the urine alkaline. This has been accomplished without rigid limitation of protein in the diet. She is still taking soda and has not been under observation sufficiently long to know the ultimate results.

#### TREATMENT

Since cystin is soluble in alkaline solutions a very important part of the treatment is to render the urine alkaline and keep it so. The lower the protein intake the easier this will be accomplished. Sodium bicarbonate is about the best for this purpose.

Pelvic lavage with an alkaline antiseptic solution should be used and certainly if we have pelvic infection. This can be done



Fig. 6

Fig. 6. Stones has disappeared from left kidney and further reduction in size of the stone in the right kidney. September 7-9.



Fig. 7

Fig. 7. Showing only small shadow on the right side. No shadows in left kidney. November 9-9.



Fig. 8

Fig. 8. Showing complete disappearance of all stones. January 4, 1913. Subsequent pictures show no shadows in either kidney. These recent findings obtained to June 9-1.

every day but every second or third day is better. The solution should be warm and an amount just below the pelvic capacity used and retained 5 to 15 minutes this depending upon the amount of reaction produced by the drug. This lavage should be followed by one with saline solution. We used in our case mercurochrome and saline solutions every second or third day. Mercurochrome is alkaline as well as antiseptic. It is also very penetrating. We believe the lavage with these alkaline solutions assisted in the disintegration of the stones in our case and hope the plan may be tested further. Of course the whole problem is unsolved and will be until its etiology is more definitely settled.

Surgery has usually been considered the proper treatment. This has been very unsatisfactory on account of the great frequency with which the stones recur. In so far as I have been able to ascertain recurrence has been the rule. Nearly all agree that the diet should have a low protein content. Every precaution should be taken to prevent infection. All instrumentation should be avoided when there is no infection until a careful microscopical and chemical analysis has been made of the urine to see if there be cystin crystals in it or cystin in solution. Cer-

tainly no ureter catheterization should be done if a non operative plan of treatment is to be pursued unless it be with the view of aiding tone disintegration by the use of alkalies in pelvic lavage.

#### CONCLUSIONS

1. The etiology of the disease is still unsolved but is probably due to faulty metabolism.
2. The urine should be examined for cystin in all cases of kidney colic and back pains whether or not they are accompanied with kidney X-ray shadows.
3. If the stone is associated with cystinuria disintegration should be attempted by the internal administration of alkalies pelvic lavage with alkaline solutions and limitation of protein diet.

I am greatly indebted to my secretaries Drs. Thompson, Todd, May and Spores for valuable suggestions and assistance in the management of this case as well as to Dr. J. A. L. Ingston who referred the case to us. It is at the suggestion of our clinical pathologist, Dr. Todd, that the plan of treatment (the alkalies) be tried. In view of rendering the urine alkaline and therefore solvent of cystin.

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# THE COEXISTENCE OF CHOLECYSTITIS AND DUODENAL ULCER IN THE SAME CASE

WITH THE REPORT OF SEVERAL RECENT CASES

By ARCHIBALD MACLAREN M.D. F.A.C.S.

HARRY OERTING M.D. S. PAUL, MINNESOTA

**S**UPPOSING the septic theory of duodenal ulcer to be correct, then the co-existence of cholecystitis and duodenal or gastric ulcer stands upon the same foundation as that existing between appendicitis and inflammation of the gall bladder.

Postmortem findings, as quoted by Judd go to prove that a healed duodenal ulcer is frequently found in patients who give no past history of digestive disturbances. Just because a patient has gall stones does not prove that they are the cause of the patient's symptoms. Every abdominal surgeon recognizes the fact that slumbering gall stones may exist for years without producing any symptoms.

The following five cases occurring in the past few months seem worth recording for the purpose of drawing attention to the combination of cholecystitis and duodenal ulcer. While no formal record has been found in the literature for the past few years we find in the report of a clinical lecture delivered by Ochsner that he has noted on several occasions the occurrence of these two diseased conditions in the same patient.

**CASE.** Patient with definite duodenal ulcer history gall bladder removed by another surgeon one year before without relief of symptoms.

M. P. E. J. age 45 patient of Dr. H. Perna. Eight years ago patient began to have symptoms of gastric disturbances, or 2 hours after eating, with vomiting. Later he had attacks of food relief and much gas coming every 3 or 4 months and lasting days or more. In November 9, he was operated upon, at Eau Claire, Wisconsin, for cholecystitis and his gall bladder was removed, bringing no relief.

**Present illness.** Symptoms of gastric distress have come on gradually. One month ago he vomited and became almost fast on account of marked discomfort.

**Physical examination.** Tender spot is present over the pylorus on fluoroscopic examination. X-ray plates showed perforated base of an old duodenal ulcer with retained barium for many hours after a meal.

**Operation.** September 14, 9. St. Luke Hospital, ether anesthesia. On opening the abdomen,

adhesions were found between the liver and the anterior abdominal wall. The gall bladder had been removed 14 months before. A chronic indurated ulcer of the posterior wall of the duodenum was found, with no evidence of phlogoplastic excision at the time of the previous operation. A short loop posterior gastroenterostomy was done and the patient made an uninterrupted recovery and reported 2 months later that his digestion was perfect and that he had gained 10 pounds.

**CASE.** Chronic obstructing duodenal ulcer and chronic cholecystitis with one large stone.

Mrs. T. B. O'B. age 54, married. The family history is negative. P. Trent has had hay fever for the past 7 years otherwise has always been well until the present illness. Menopausal age 53 years ago.

**Present illness.** In April, 1921 patient began to have what she describes as attacks of stomach trouble. The first attack came on suddenly with a chill, severe nausea and vomiting of more or less tasteless, sticky fluid. The vomiting continued almost constantly for 6 weeks without any jaundice or pain, but she became weak from lack of nourishment. In the fall of 1921 she had a similar attack but of shorter duration. During the following year there were several such attacks, always with nausea and vomiting but no pain. In September 9 the attacks became very severe and she vomited continuously and became hysterical. As before there was vomiting without pain or jaundice. Vomitus consisted of a sticky fluid. Between these various attacks she has had good appetite and has eaten everything because, as she says, food apparently was not a factor in her attacks. She first consulted us on October 5, 1921 in quiescent period, and was placed in the hospital under observation and remained for 4 days. X-rays of the gall bladder, kidneys and ureters were negative as were all the routine laboratory findings. She was sent home with instructions to report at the office for further observation, but nothing was heard from her until November 1921. During this interval there had been three attacks of chills, nausea, and vomiting of about 3 days' duration each. During these attacks there was no pain but feeling of tenderness noted between the shoulder blades.

**Physical examination.** A rather obese individual with evident recent loss of subcutaneous fat. Except for a complete prostatica the findings were negative. Blood pressure 40-80. Urine negative. Ewald meal free hydrochloric acid, 58 total acidity 94. Microscopic and chemical examination negative. Fluoroscopic examination of the stomach showed



Fig. 1. Case. Perforating duodenal ulcer seen at X-barium remained in this pocket for 24 hours after barium meal.



Fig. 2. Case. Ulcer crater shown by arrow. Gall stone not seen in picture because it is transparent cholesterol stone.

definite constant filling defect in the duodenal cap verified by plate studies. A diagnosis of duodenal ulcer was made.

**Progress.** The patient was put to bed in the hospital and placed on rigid diet of 800 cubic centimeters of milk in 24 hours for 6 days with feedings on the even hour and alkaline powders on the half hour. She complained constantly of feeling as if there was a lump under the manubrium at the level of the third rib, and although she had no attacks she apparently did not improve and on December 9, 1921, an operation was advised.

**Operation.** Ether anesthesia was given and on opening the abdomen dense adhesions were noted in the gall-bladder region. The gall bladder was thickened and indurated and contained one large stone. Cholecystectomy was performed. There was a marked induration and thickening along the posterior wall of the duodenum from an old chronic ulcer. This induration extended just beyond the pyloric vein and produced partial obstruction. A posterior gastro-enterostomy using a short loop, was performed and a drain placed at the stump of the cystic duct, and the abdomen closed. The operative diagnosis was cholelithiasis and duodenal ulcer.

**Postoperative.** Convalescence was uneventful. The patient lost the lump on the second day and says she has not felt so well for years.

On going over the entire past history after the operation the patient recalled that about 1 year ago she had had a short period in which she was troubled with indigestion and gnawing in the stomach just before meal time, but that it soon passed away.

**Case 3.** Patient with definite digestive attacks occurring every few months for the past 5 years.

Mr. A. B. age 30, single. Family history is negative. Patient had scarlet fever in 1900, diphtheria in 1906, no sequelae. He had a ruptured appendix in 1903, which was drained and the wound not closed.

**Present illness.** During 1918 patient had two or three attacks of what he describes as tightness in the chest lasting about 2 or 3 hours. These attacks came on at various times and had no apparent relation to meals. During 1919 he felt perfectly well. Early in 1920 there were several attacks similar to those in 1918. Beginning in November 1921 the attacks became more and more frequent and there was a pressure sense in the upper abdomen but no pain or nausea. In February 1922 the attacks became severe, occurring every 10 days, with pain radiating from the upper abdomen to both shoulder blades. The duration of the attacks never exceeded 2 hours. He vomited only once and that with one of the last attacks. Vomitus was watery and very sour. Stools have been loose all the time since the beginning of the attacks in 1918.

**Physical examination.** A well-developed and nourished individual. Abdomen showed a weak abdominal scar in the right lower quadrant with a slight hernia in the upper angle. There was tenderness on deep pressure in the mid epigastrium. The balance of the examination was negative. Blood pressure 125/75. Urine, blood, and stools, were negative. X-ray plates showed a large cluster of gall stones. A diagnosis of cholelithiasis was made and an operation advised.

**Operation May 16 1922.** On opening the abdomen there were found marked adhesions in the region of the gall bladder and the gall bladder was firmly adherent to the under surface of the liver. Cholecystectomy was performed. The gall bladder contained eight stones the size of hazelnuts and thirty smaller stones. Convalescence was uneventful. There is no record of exploration of the stomach or duodenum. Operative diagnosis: cholelithiasis.

**Subsequent history.** On June 13 1922 one month after operation, patient reports a return of distress in the mid epigastrium about as before his opera-





Fig. 3 (Case 3). A cluster of gallstones probably of the duodenal variety. Duodenal ulcer probably present but not proven.



Fig. 4 (Case 4). Gallstones (A). Pyloric end of stomach much rugated and irregular. No duodenal cap. Almost complete retention of barium meal given 4 hours previously.

tion. There is soreness little to the left of the median line which is not relieved especially just before breakfast. Fifteen minutes before eating there is only sensation of lump in the stomach. This gradually disappears until just before noon when she says she is hunger pained and this pain is present again just before dinner in the evening. Bowls are still loose.

**Physical examination.** A little tenderness is present on deep palpation in the mid epigastrium. Otherwise the examination is negative. Urine negative. White count made. Stools not examined. 1 ml meal shows free hydrochloric acid 4 total acidity 45. Fluoroscopic examination shows a apparently normal stomach. Duodenal cap pulled posterior and rather fixed, probably fibrous, no definite filling defect although the cap is not symmetrical. Plates do not show the cap very well, probably because of its posterior position.

Patient placed on modified Sippy diet and reports that she is getting only slight relief.

**Case 4.** Combination of cholecystitis and biliary lithiasis with many stones and indurated duodenal ulcer with complete inflammatory obstruction of the pylorus. Patient slowly starving to death.

Mrs. J. H. S., 66 years old. The past history is negative. Menopause 5 years ago.

**Present illness.** In the winter of 1930 patient had fall while getting out of automobile and was sick in bed 3 months during which time she was on milk diet. Shortly after the accident she began to vomit and on one occasion vomited small amount of blood and had dull pain in the epigastrium. The vomiting continued off and on for some weeks and then stopped. No blood or tarry stools had been noted. During the summer of 1931 she felt perfectly well but in the fall began to be constipated and had occasional vomiting spells. Once September 9 vomiting continued and was ill

most of blood. A local doctor asked out her stomach 3 or 4 times and she took some laxative powders. Since September she has had constant dull pain in the epigastric region particularly about relation to meal. She has lost about 20 pounds weight since September. She comes in now because of stomach distress persistent vomiting and palpable mass in the pyloric region which she has not noticed for the 16 weeks.

**Physical examination.** A poorly nourished woman with dry skin. Head face bright red lungs negative. Abdomen swollen, asymmetrical in right upper quadrant with distention about the size of an orange which is slightly tender and slightly movable. X-ray shows large low stomach low pole at symphysis but otherwise normal. Duodenal bulb irregular in outline and is irregular in course. Apparently it is extrinsic in origin which is slightly movable but does not descend during inspiration and presses on the food in plates. Two small multiple gallstones. Twenty-four hour fluoroscopic examination shows almost complete retention of the barium meal. I would meal 1000 cubic centimeter free hydrochloric acid 4 total acidity 75 lactic acid blood.

**Operation.** I started under local anesthesia and without any pain. On opening the abdomen there were found many adhesions between the gall bladder and duodenum and large inflammatory mass in the duodenum from a perforated ulcer. The gall bladder thickened and full of stones. A post mortem gastroenterostomy performed. The gall bladder full of stones but was not disturbed. A report on piece of tissue removed for microscopic examination as follows: Tissue lymph node showing hyperplasia. It might be expected node draining field of chronic inflammation. Temperature never over 100 degrees while in hospital. Opt on the day of admission when it

was 100 degrees. The patient gained 30 pounds in the hospital and made a perfect recovery.

**CASE 5** Cholelithiasis with a healed duodenal ulcer.

Miss H. S. age 50, patient of Dr. J. McLaren. When patient was 38 years old she had a sudden hemorrhage from the bowels and for the next 6 months had a marked duodenal ulcer history but no symptoms of duodenal ulcer since that time.

*The present illness* Dates back 9 years at which time she had a typical gall bladder attack with very severe pain lasting 4 hours. Later had a second attack which was also very severe. The third attack was 3 months ago lasting all night, and followed by jaundice.

*Operation* Showed a healed duodenal ulcer with no induration or obstruction chronic cholecystitis

and a small shrunken thickened gall bladder with one stone the size of a hen's egg and three smaller stones. There was an enlarged fibroid uterus. The gall bladder was removed and nothing was done to the duodenal ulcer or to the fibroid uterus. The patient made a good recovery.

#### CONCLUSION

It is our conclusion that when operating upon a patient suffering with gall bladder disease especially in the presence of gall stones, we should make it a point also to examine the stomach and duodenum carefully to make sure that a duodenal or gastric ulcer does not exist at the same time.

# HÆMOLYTIC STREPTOCOCCI AND THEIR RELATION TO PREGNANCY AND THE PUERPERIUM

R. A. E. KANTER, M.D., AND J. PILOT, M.D., CHICAGO

From the Out Patient Obstetrical Department of the First Division Hospital and (cont.) The University of Pathology and Bacteriology, University of Illinois, Chicago, Illinois

WE are well aware of the vast amount of material which has been written on the subject of the vaginal flora in relation to the production of puerperal sepsis. A review of the literature however shows no uniformity or consistency in the methods of study in regard to media used, methods of obtaining cultures and interpretation of findings. Another striking feature is that no special emphasis was made to differentiate the streptococcus hemolyticus from the other types of the streptococcus. For this reason we feel that a study of the puerperium especially with the reference to the streptococcus hemolyticus, would be of value.

Obstetricians agree that external influences have a very important relation to the production of puerperal sepsis. There is however quite a large number of instances where as far as it is possible to determine no external influences have been at play. This so called auto infection theory as a cause of puerperal sepsis has been a matter of contention for many years and is still unsettled. It was thought that a combined clinical and bacteriological study of pregnancy might give some light on this subject.

The following tabulation gives an idea of the frequency with which streptococcus hemolyticus is found in the vaginal secretion by certain investigators:

- I 4 per cent of cases by Burckley (3)
- I 7 per cent of cases by W. Kinn (4)
- I 5 per cent of cases by Wister (5)
- I 60 per cent of cases by Williams (6)
- I 85 per cent of cases by Bargarbom (7)
- I 4 per cent of cases by Doederlein (8)
- I 4 per cent of cases by Blacklock (9)
- I 5 per cent of cases by V. Hla (10)
- I 5 per cent of cases by Kottmann (11)
- I 30 per cent of cases by Stala (12)

In this tabulation no distinct effort was made to separate the streptococcus hemolyticus from other organisms of the same group.

During pregnancy the hemolytic streptococcus was found in

- 5 per cent of cases by Goessart (13)
- 50 per cent of cases by Diskin (14)
- 75 per cent of cases by Benabrook (15)
- 4 per cent of cases by Jettie (16)

During the puerperium streptococci were found—

In 30 to 50 per cent of women examined by Bumm and Sigwart (5)

In 20 per cent of women examined by Lea and Sickelbothum (13)

In 9 per cent of women examined by Williams (21)

A great disparity is shown in the results obtained. Many explanations have been given for this variance.

Kuester (12) in 1913 divided the flora into two groups, the first group included those bacteria found between the introitus and the hymen and the second group those found between the hymen and the external os. He stated that more streptococci were found in the first group. Doederlein (8) stated that the vaginal secretion might occur in one of two forms which he designates as normal and pathological. He maintained that no streptococci could be found in the normal secretion while they could be found in 10 per cent of the pathological secretion. J. W. Williams (22) held that the number of streptococci found depended upon the manner in which the cultures were made. Fewer streptococci would be found when the Menge tube was used and when a speculum was used he believed that the organisms from the vulva were pushed into the vagina and thus contaminated it. Frick (5) in 1914 showed that the results obtained were the same irrespective of whether the secretion was obtained by means of a Menge tube or speculum. She also showed that streptococci could be cultured in 75 per cent of cases from vulva and 55 per cent of cases from vagina and that personal cleanliness had a great deal to do with the finding of organisms on the vulva.

Assuming now that a standard method of obtaining material for study was developed and that the results obtained by workers were uniform there still would remain a difficult problem namely that of determining the pathogenicity of the organism.

Schottmueller (16) brought forth the idea that all hæmolytic streptococci are virulent. This idea is not tenable at the present time. Other efforts have been made to detect specific differences between the varieties of streptococci according to the length of their chain their mode of growth and staining reaction. According to Scheib (15) it is impossible to distinguish between streptococci existing as saprophytes in the lochial discharge and those causing puerperal infection.

#### MATERIAL FOR STUDY

Ninety six women who were under the care of the outpatient department of the Presbyterian Hospital and Central Free Dispensary were used for the bacteriological study. There were twenty-five para I, twenty-seven para II, nineteen para III, three para IV, three para V, three para VI, one para VII, two para VIII, one para IX, three para XI and one para XII in this series. In two parity was not given.

The discharge for culture was obtained at several prenatal stations and at this time the character of the discharge was noted. Using Doederlein's classification there were 19 profuse discharges, 67 moderate discharges and in 10 no discharge was noted at all. Thus there were 19 abnormal and 67 discharges. There was characteristic discharge in 8 instances which were as follows:

- In Case 28 profuse yellow
- In Case green purulent
- In Case 9, late purulent
- In Case 39 frothy discharge
- In Case 39, profuse yellow
- In Case 55 green purulent
- In Case 60, greenish yellow
- In Case 65, bloody discharge

The period of pregnancy at which the secretions were obtained varied from the third month to term.

A clinical study of the puerperium was made on 67 of the 9 cases which were studied bacteriologically. Twenty-nine cases were lost

sight of some of which were delivered by private physicians some went to a hospital a few left the city and in a small number a diagnosis of no pregnancy was made at their first visit to the Clinic. With a few exceptions the cases studied clinically were delivered at home and the others sent to the hospital for some pathology. At home they were attended at their labors by senior medical students under the supervision of an interne of the hospital and the obstetrical nurses in charge of the outpatient Department. Except in the few cases where the baby was born before the arrival of the students the patient had the usual vulvar preparation.

The three cultures were obtained in the following manner. One from the lateral wall of the vagina after separating the labia rather widely the second from the posterior fornix and the third from the patulous os of the cervix. The latter two cultures were obtained by means of a sterile speculum. Care was taken not to contaminate the secretion from the cervix with secretion from the posterior fornix.

#### METHOD

The swabs were inoculated within 2 to 2 hours after collection directly into infusion agar to which defibrinated human blood was added in proportion of one part blood to ten of agar. The blood agar was poured into Petri dishes and readings made at the end of 24 and 48 hours.

The hæmolytic streptococci of the beta type appeared as small granular colonies surrounded by a clear zone of hæmolysis measuring two to four millimeters across. Streptococcus colonies forming grayish green zones were classified as streptococcus viridans in a few instances the grayish green zones were surrounded by a narrow zone of hæmolysis and these were termed the alpha type of hæmolytic streptococcus.

All hæmolytic colonies were transplanted on blood agar plate for further identification. Colon bacilli and staphylococci occasionally formed hæmolytic colonies but could be readily differentiated from streptococci. The beta hæmolytic streptococci in pure culture on blood agar plates formed small discrete biconvex colonies. In sugar broth they formed a



This patient was delivered by cesarean section.

In analyzing possible sources of streptococcus puerperal sepsis one must consider the (1) organisms in the vagina of the patient, (2) organisms introduced by the hands or instrument (3) organisms from throats of physician and attendants who may be harboring virulent streptococci (4) streptococci from patient's own throat, sinus, or other infected area.

1. As to organisms in the vagina it is our experience that the hæmolytic streptococcus is rarely present in the normal vagina, also that the organism found is not very virulent and that most hæmolytic streptococcus infections must be considered exogenous.

2. The introduction of streptococcus from without through droplets from the throat secretion which may be deposited on instruments and hands is very probable, for these droplets often contain hæmolytic streptococci.

3. Direct droplet infection from throat of operator or attendant, by sneezing or coughing is also possible such droplets may be considered to harbor hæmolytic streptococci for it has been shown by Davis (23) that the normal throat harbors hæmolytic streptococci in practically one hundred per cent of individuals. If a sore throat is present the streptococcus has an added virulence and is more dangerous to the pregnant woman.

4. The patient's own throat as a source of organisms in the production of sepsis may lead to hæmatogenous infection of the uterus and adnexa.

The use of a gauze face mask during delivery the exclusion of attendants having sore throat from the delivery room, and the isolation of patients having streptococcal sore throat will be great factors in reducing the number of cases of streptococcus puerperal infection.

## SUMMARY

1. The normal vagina rarely contains virulent hæmolytic streptococci and there is no evidence that the presence of such streptococci plays any part in the production of puerperal sepsis.

2. Any manipulation of vagina, either for examination or operative procedure increases the possibility of puerperal sepsis.

3. Puerperal hæmolytic streptococcal infection is regarded in most instances as evidence of exogenous infection.

4. Droplet infection from attendants is possible and the use of gauze masks during delivery and the exclusion of those having sore throat from the delivery room and from attendance on puerperal women is clearly indicated.

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# PROTEIN SENSITIZATION IN ISOSKINGRAFTING

## IS THE LATTER OF PRACTICAL VALUE?

By J. WILL HOLMAN, M.D., BOSTON

Formerly Resident Surgeon, Johns Hopkins Hospital, Baltimore

ISO or homo skin grafting is frequently employed by the profession to the wondering delight of a credulous laity who enjoy contributing small squares of skin as sacrificial offerings on the altar of self-inflicted martyrdom. It is a procedure which has captured the imagination of the public and still holds enthralled a considerable number of the members of our own profession. That such grafting is most often a failure and only in isolated cases a success seems little known and it is still regarded without hesitation as a procedure giving uniformly good results quite comparable to those obtained with autografts. A study of the literature, however, gives an entirely new conception of the difficulties to be expected and a pertinent case is here presented as illustrating one of the more unusual complications attending such a procedure.

A 6-year-old boy admitted to the Johns Hopkins Hospital on July 10 following extensive laceration of the left thigh and lower leg by that monster, Molocho, the motor truck. He was brought to the hospital immediately and an extensive debridement was performed 4 hours later after recovery from profound shock. There were no fractures but the entire leg from the proximal ligament to the ankle had been stripped loose. The considerable trauma to the adhering muscles and the laceration extending into the knee and ankle joint was vigorous dissection followed by the debridement and on August 18, the first skin grafting was performed. Both mother and son were found to belong to blood group II and there was no agglutination on matching the two bloods. One hundred fifty-one small deep punch grafts were removed from the mother's thigh and applied to the inner and anterior granulating surfaces of the debrided leg. All the grafts took as indicated by the appearance of dark discoloration, red in the center of the small punch grafts. Within 48 to 72 hours after their placement these areas took on much like small hemorrhages into the dermis and it is our belief that these hemorrhages occur through the wounds in the vessel walls induced by operation by transferring the graft with sharp needle. The appearance of these small ecchymoses is proof that vascularization of the graft has begun and therefore that the graft has taken.

On August 23 it was noted that the grafts had begun to spread at the periphery. Ten days later 163 additional punch grafts were removed from the mother's thigh and applied to the balance of the denuded surface of the child's leg. Within 3 days all of the graft showed signs of taking and the entire wound was in excellent condition. By September 17 the leg had become almost completely epithelialized by the spreading of the grafts and only a few small grafting areas remained uncovered. About 3 weeks following the second skin grafting it was first noted that rather widespread desquamation of the skin had developed over the entire body and marked desquamation of the skin was taking place on the scalp, face, arms, trunk, and legs. This desquamation also involved the grafted areas and on September 30 small blisters on the grafted surfaces were noted for the first time resulting in fresh granulating areas which had previously been well covered by epithelium.

A consultation was held with the clinic on skin diseases and the general desquamating condition pronounced as eczematous or possibly pemphigus. The desquamation proceeded at an alarming rate however and thirty months after the initial complete epithelialization of the leg, all the new epithelium except the original grafts had melted through a process of repeated desquamation. In the meantime the skin over the rest of the body was in a deplorable state. Weeping sores and bleeding cracks had appeared in the skin of the face and arms, causing considerable discomfort and a very unpleasing appearance (Fig. 1).

About this time it occurred to me that the general dermatitis was most probably phenomenon of anaphylaxis or protein intoxication, and a manifestation of sensitivity to the foreign protein of the mother. The child could not but have a slight rise of evening temperature with high pulse rate and the appearance of slightly blood-streaked stool indicated possible extension of the desquamation to the mucous surfaces of the intestine. As the original small punch grafts obtained from the mother were still present it was decided that these should be removed as being the cause of the patient's difficulties. On December 3, therefore, 3 months after the first appearance of the dermatitis, all the original grafts, deeply imbedded in granulation tissue, were excised. Within 7 days there was tremendous improvement in the general condition of the patient and the exfoliative dermatitis rapidly disappeared.

In less than 4 weeks after the removal of the foreign grafts the child's skin had healed entirely so that a third skin-grafting was undertaken, this time from the patient's own thigh. One hundred to fifty-two autografts were applied on this occasion, followed in 3 weeks by an additional 87 grafts. No difficulty was experienced in obtaining a permanent epithelial covering for the entire leg by means of these autografts (Fig. 2).

Isoskingrafting has heretofore received scant attention from the standpoint of the reaction of the recipient to the foreign protein introduced from the donor. A plausible explanation of the unusual difficulties encountered here is that we were dealing with an intoxication or poisoning due to a foreign protein. The first application of skin-grafts from the mother served to sensitize the patient to this protein. The second group of grafts precipitated the anaphylactic reaction dependent upon this hypersensitiveness to the mother's protein, a reaction which manifested itself mainly by a very stubborn exfoliative dermatitis. This persisted over 3½ months, but disappeared immediately upon removal of the foreign skin grafts. This observation may serve to explain the failure of isografts in those cases in which repeated trials are made, i.e. a protein sensitiveness once established is quite effective in preventing subsequent grafts from taking, or from thriving after they have once taken. A pertinent case has just been reported to me in which four trials at isografting were made with melting away of each set of transplants.

Following our observations on this case, a search through the literature was made and it was found that Underwood in 1914 had reported the following somewhat similar difficulties in a case of extensive burns.

Skin grafting was begun as early as the local conditions warranted, skin being employed from the patient's brother and later from friends and neighbors. In all, grafting was done at twenty-one sittings and skin was furnished by seventeen different persons. The dates of the earliest grafts are as follows: November 26, 3, December 5, 9, 10, 11, 13, 14, 15, 17. These earlier grafts took readily and thrived, but just about the last date mentioned, trouble began. An area about 6 inches square was grafted and did not take; then some of the old grafts began to melt. Succeeding grafts also

failed. Over a large area of the left thigh and back where no grafting had been done but autogenous epithelization had progressed well, the tissues mushed and coored blood badly. Hematuria appeared and lasted 2 days, and the heart impulse became irregular and weak. January 23 I ventured again to use a human graft, this from the patient's sister. A temporary take occurred but did not thrive well enough to offer much encouragement. The only human graft which thrived thereafter was a very small one from the patient's mother.

#### Underwood observes

So far as I am aware there has been no effort to identify the reaction accompanying repeated skin-grafting over large areas with that of anaphylaxis, yet it seems clear that they are closely related if not identical. In the case here reported it is to be noted that not only did two acts of foreign tissue successively lose their power to be transplanted, but also in each case caused distinct reaction in the patient. Yet at the same time, grafts from the patient's sister took to a degree and one from the mother perfectly. One may infer that consanguinity has a favorable influence.

It is evident that no attention was paid to blood grouping and in view of the later work by Schoen<sup>2</sup> and Masson<sup>3</sup> on blood grouping in skin-grafting has reference to consanguinity as a favorable influence is prophetic.

Gatch, in 1911 reported a case of isoskin-grafting on three separate occasions with failure of each graft, but he does not attempt to explain it.

George Perthes<sup>4</sup> reports the following observation in an article entitled "Is Homoplastic Skin-grafting Between Brothers and Sisters Comparable to Autografting?"

A factory hand, age 19, female, whose hair had been caught in machinery was brought to the clinic with total evulsion of the scalp. The attempt, made on the day of the accident, to cover the large wound surface with Thiersch grafts from the thigh was successful only over a small area of the crown. Ten weeks after the accident the whole back of the head was covered with bright red, uniformly good granulations. Transplant upon according to Reverdin was now carried out as follows: on the left half of the granulating surface nine grafts from the patient herself were applied; on the right, nine skin grafts from her own sister who was two years older than the patient. Both were applied under exactly the

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<sup>1</sup> E. Underwood. "Anaphylaxis following skin-grafting for burns." *J. Am. Med. Ass.* 1914, 10, 172.



same conditions. Ten days later all the grafts, without exception, autografts as well as isografts, were firmly healed that is, they appeared to be all alike, and remained firmly attached to the underlying tissues, after careful attempts had been made to wipe them off. Therefore eleven more grafts from the sister were applied to the right side of the head. Sixteen days after the first transplantation one could notice an essential difference between the autoplasic and homoplasic grafts. While the former showed distinct border of newly formed epithelium, the latter on the contrary had diminished from the edge outwards, evidently nibbled away by the surrounding granulations. This decrease could be plainly recognized in the grafts applied at the last operation. Four weeks after the first Reverdin transplantation the contrast between the grafts of different origin was still more striking. While the grafts taken from the patient herself had enlarged their diameter on an average from 5 to 20 millimeters by the formation of new epithelium, those grafts taken from the sister had entirely disappeared.

It is obvious, concludes Perthes, that one cannot expect the same results from homotransplantation—even from brothers and sisters—as from autotransplantation.

Lever in his exhaustive work on free transplants writes very discouragingly of the value of homotransplants, and states very positively that one can expect success only when autografts are employed. He emphasizes his unbelief by citing six cases of auto- and isografts on the same wounds with total failure of each isograft and complete success of each autograft. To quote him exactly we find

In view of the frequent assertion that it is possible to get isografts to take, in spite of conclusive clinical experiments and histological findings to the contrary it seems important to state the source of errors in observation which lead to this belief among doctors, belief which is like a fable handed down from the olden days. The errors of observation depend mainly upon the fact that: isografts there is rather firm adherence of the graft until the third week which simulates take. If the defects are not large, there occurs under the drying desquamating isograft an epithelization of the wound surface from the wound edges. This new epidermis is easily mistaken for the work of the isograft. But even with large defects and particularly in granulating wounds following burns, similar epithelization is possible under the drying isograft through the spreading of small cell rests of epidermis, which have remained intact and unharmed by the initial injury.

This last contingency is frequently met and undoubtedly is a very important agency in

Lever, E. Die Freien Transplantationen (4 vols.) Die Neue Deutsche Chirurgie

the healing of large granulating areas without grafting. In the case under discussion certainly neither of the factors mentioned by Lever was concerned. Certainly there occurred complete epithelization of the denuded leg by rapid spread of new tissue from the grafts transplanted from the mother. Microscopic sections of these grafts demonstrate conclusively that they had taken and were living tissue at the time of their removal 4 months after their transference from the mother. That isografts will take is demonstrated without the slightest question but that they may melt away subsequent to a successful take is also demonstrated. The evident intoxication associated with the melting away process in this case may be accounted for by the application of so large a number of grafts, from which absorption of foreign tissue juices could occur. The number of grafts transferred from mother to son within a period of 10 days totalled 319. This would equal a square of skin approximately 15 centimeters by 15 centimeters. The number of autografts which can be applied within a similar period of time is limitless. In an adult case 850 grafts were applied within a period of 3 weeks with a loss of only 23 grafts, while in another instance 801 grafts were applied with a loss of only 3.

To test further the usefulness of isografts we undertook a series of studies on the following case:

M. C. male, age 8 months, was admitted to the hospital on February 27 suffering with an extensive burn of face and chest wall. By March the wound was well covered with fresh, clean granulations, and accordingly a group of autografts was applied in the left axilla. Each small punch graft took and spread rapidly. The child was found to belong to blood group IV. On April 3, 9 isografts were removed from J. W., a member of blood group IV and applied to the chest wall. Figure 3 and twelve large punch grafts, 5 Figure 5 were transferred from E. H., a member of blood group II. At the same time autografts were applied to the wound. Figure 3. All contributions took and are in excellent condition on April 19 as indicated in Figure 4, taken 6 days after the application of the grafts. On April 25 E. H. for the second time contributed ten small punch grafts, Figure 5. This photograph was taken on May 3 and shows the rapid spread of the autografts, and the coalescing of the isografts in groups, and 5 by the extension of new epithelium from their periphery. On May



Fig. 2 November 30, 5 months after the re-grafting. The leg is bare except for original small islands of skin. Dermatitis with bleeding fissures on face and arms.



Fig. 3 Appearance of child on May 1 showing the complete epithelization of the leg by autografts.



Fig. 3



Fig. 4



Fig. 5

Fig. 3 Photograph of M. C. on April 3, showing the epithelization of the arm by autografts and the application of autografts from J. W. to autografts from E. H. C. autografts from M. C. umbilicus.

Fig. 4 M. C. 16 days after grafting showing spread of autografts, and extension of epithelium from autografts.

Fig. 5 Appearance of grafts on May 1, showing (1) the rapid epithelization by the autografts, (2) the spread of epithelium from the autografts in groups (3) and (4) autografts from M. C. applied on April 10 which have taken and begun to spread (4) autografts from E. H. applied April 5.

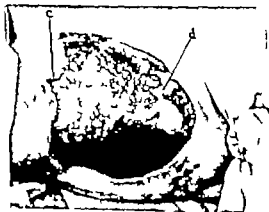


Fig. 6 May 16, see advancing epithelium from autografts but complete disappearance of autografts in groups (3) and (4). The autografts in group (4) just begun to show regressive change not yet demonstrable in photograph. Epithelium advancing rapidly from umbilicus.



Fig. 7 Photograph on June 14, showing the complete disappearance of the autografts in group (4) and the beginning spread of epithelium from autografts which were applied on June 8.



Fig. 8. Microscopic appearance of homograft removed from group 8 on the sixth day after application. The epithelium has spread about 8 millimeters beyond a, the edge of the original graft.



Fig. 9. Appearance of homograft removed on thirteenth day after application, showing the thin layer of epithelium stranding from the edge a, of the original graft b, over the granulation tissue c.

3, however just 3 days after the application of the isografts, there was noted a definite change in the appearance of the new epithelium. The edges seemed to have receded; in fact, they were more clear cut, instead of an indistinct advancing edge and they seemed thinner. Successive layers of cells seemed to be cast off each day until all the new epithelium which had spread from the original grafts had disappeared, followed several days more by the disappearance of the epithelium overlying the grafts themselves. By May there remained only fibrous vestige of each of the original bits of skin (Fig. 6). The second group of ten grafts transferred from E II on April 3 did not take but disappeared simultaneously with the first groups of isografts. The disintegrating process involved not only the grafts contributed by member of dissimilar blood group, but also those from member of the same blood group.

In the meantime on April 10, a number of isografts were contributed by a third donor, M F member of blood group IV whose blood matched that of the host. Again the grafts took, spread, and remained in excellent and healthy condition (cf Figs 5 and 6) until about May 14 3 days later when they too, began to undergo change and within 10 days they had melted away entirely (Fig. 7). Meanwhile the autografts are constantly spreading and advancing the epithelialization of the denuded area.

The failure of two isografts of the same blood group and of one isograft from a dissimilar blood group calls one's attention very forcibly to Lever's emphatic statement that the success of isografts may be relegated to mythology. Furthermore it is significant that

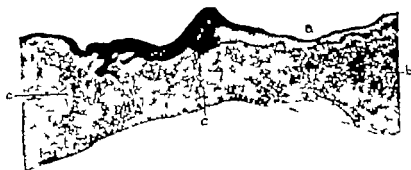


Fig. Appearance of an isograft removed on the twenty-second day after application, the epidermis has advanced considerable distance from it with remarkable thickening of the epidermis or the granulation tissue so as to resemble the normal epidermis overlying the original graft, *b*.

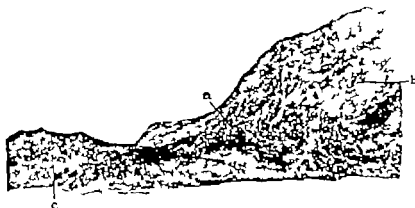


Fig. Isograft removed on the thirty-second day after application, showing almost complete disappearance of epidermis overlying both the original graft, *A*, and the granulation tissue. One can see just small rim of delicately stained epidermis to left of *C*.

in each case of isografting here attempted there was prompt vascularization with an early outgrowth of epithellum from the graft edges followed in about 24 to 36 days by complete disappearance of both graft and new epithellum. Moreover the grafts from an individual of the same blood group acted no differently from those of a dissimilar blood group. It is interesting to note also that during the days in which the isografts from the first two donors were rapidly disappearing the grafts from the third donor were spreading nicely and in excellent condition. It is obvious that the agency which caused the first grafts to disappear had no effect on the viability of the grafts from a third donor. It is highly suggestive that the destroying agency is specific for each set of grafts and it seems plausible

to suppose, therefore that each group of grafts develops its own antibody which is responsible for the subsequent disappearance of the new epidermis.

Concerning this point the observations of Schoene in his monograph on *Die Heteroplastische und Homoplastische Transplantation* (1912) are worthy of note.

The primary toxic effect of tissue juices of the host upon the transplant cannot be denied. We know that the serum of a human under certain circumstances can hemolyze the red corpuscles of another. One cannot doubt but that through a similar process the success of a transplant can be frustrated. In these toxic injuries surely lysis and agglutination effects are not alone concerned. Negre calls attention to slight differences in the salt concentration of the blood. Such influences, which may in part depend on osmotic activity may be of the greatest importance in toxic manifestations.

In addition to the injury to the transplant by the host, must recognize also an injury to the host by the transplant. Besides acute poisonous manifestations the host as one sees not infrequently in blood transfusions, and besides rapid fall of off of transplanted piece of skin, such as I experienced in mice and Lister in humans, we recognize also gradual disintegration of the transplant as well as very slow languishing away of the host following the transplant. There can be no doubt that mice frequently succumb following the death of the large foreign skin transplant. That the resorption of other foreign tissues of blood and liver can be fatal is well known and I have seen it frequently. Often it is difficult to know how far the living transplant injures the host but we must not consider too lightly the possibility of primary reciprocal toxic injury which may in many instances be only a slight

A very important question also is how reactions of immunity and anaphylaxis are responsible for the failure of foreign transplants. That such reaction occurs cannot be doubted. It is not difficult for me to understand how the rushing out and absorption of transplanted tissue in the first day is quite sufficient to call forth secondary reaction

which is responsible for the death of the rest of the transplanted tissue. I recall the experiment of Sachs concerning the death of blood corporcles in foreign organism accompanied by the simultaneous appearance of specific anisocytosis and the article of Weal concerning the appearance of anaphylactic reaction ten days after the injection of foreign serum into the corner of rabbit's eye. We may with certainty assume that analogous occurrences may follow the implantation of similar but foreign tissue or albumin. Therefore it is scarcely to be doubted that such immunizing reactions are of considerable importance in the question of homologous transplantations. The occurrence of death of the transplanted tissue after ten days is in agreement with this.

Our observations furnish definite evidence in support of Schoene's view. The progress and decline of each set of isografts is well illustrated by individual grafts removed for microscopic study from group b. Grafts were removed on the sixth, thirteenth, twenty-second and thirty-second days after their application (Figs 8, 9, 10, 11). The first figure shows the graft with evidence of a beginning extension of epithelium from the edge. By the twelfth day the epithelium had advanced over the granulation tissue in a very thin layer (Fig 9) which gradually thickened until it had assumed the character of normal epithelium (Fig 10). The specimen removed on the thirty-second day showed only the slight

est vestige of very delicately stained epithelium (Fig 11). An identical picture was obtained in sections of individual grafts removed from groups a and b.

The full cycle of the isograft ranges from approximately 24 to 30 days. It is easy to understand my takes of observation on wounds where epithelialization from the edges is sufficient to cover the granulating surface in that time and it is also apparent that observations on isografts must be extended over a considerable length of time to ascertain their exact and ultimate fate. To report a successful isograft on the basis of observation covering 10 to 20 days only is obviously not of the slightest value.

Of particular interest also is the evidence presented of a specific process of disintegration in giving a specific antitoxin for each set of grafts. The contributions from the third donor remained in excellent condition during the manifest disintegration of the grafts from the other two donors and it was not until 4 to 5 days after the total disappearance of the first isografts that the third group showed signs of disintegration.

Our experiences with isografting therefore prompt us to recognize and stress a principle in isografting which has heretofore received scant attention and little emphasis, namely the possibility of sensitizing the patient to the foreign protein of the graft. If a similar protein is again introduced or if the original graft spreads one is very likely to encounter the danger of a protein poisoning a reaction comparable but probably not identical with that of anaphylaxis. This protein sensitization or poisoning may manifest itself by a general reaction as in our first case or only by a gradual disintegration of the foreign transplant as in our second case.

Our observation also prompts us to question very strongly the value and wisdom of ever attempting isograft when there is any skin available for autografts. Certainly if one set of grafts melt away it would be sheer folly to attempt further isografting from that same donor and probably also from any donor. Our experience also furnishes contributory evidence to the claim that successful isografts exist only in fable and not in fact.

# DEPARTMENT OF TECHNIQUE

## RESECTION OF THE KIDNEY IN NEPHROLITHIASIS

By HUGH H. YOUNG, M.D., F.A.C.S., BALTIMORE, MARYLAND  
From the James Buchanan Brady Urological Institute, Johns Hopkins Hospital

**I**N a previous paper<sup>1</sup> I reported a case of renal calculus in a case of biald pelvis and double kidney. The case with which one-half of the kidney was removed from the other and the cut surface closed up by sutures with little loss of blood has led me to consider the advisability of resection in cases where a stone could not be removed through the pelvis and the renal cortex was so much distended or destroyed that there was little probability of its return to normal after simple nephrotomy for removal of the calculus. For sometime, therefore, I have had it in mind to resect the diseased portion of the kidney along with the stone in such cases and I wish to report herewith a case in which this procedure has been carried out.

**H. L. S.**, 504 BUI, age 44, as admitted complaining of pain in the urine. About 8 years before the patient had been operated on in New York for floating kidney. Notes of the operation which as carried out has been obtained. At or about the same time the patient underwent appendectomy.

Several months ago he was examined for kidney insurance and rejected on account of albumin, pus, and blood in the urine. He has had no pain nor discomfort, and urination is normal. An X-ray showed a stone in the right kidney.

**Examination:** The patient is a well-nourished man and apparently of good strength. Lungs: percussion normal, except for slight dullness at the left base. At this point there is a scar (operation for suppurative pleurisy 30 years ago). The breath sounds are little distant and slightly roughened. Lungs otherwise normal. Heart: normal. Abdomen: in the right side there is a scar of the operation performed 8 years ago for floating kidney. There is no tenderness and no enlargement to be made out. Left kidney negative. Genitalia: negative, except for slight induration of each epididymis. Rectal prostate and seminal vesicles are negative. Urinalysis: slightly cloudy, specific gravity 1.015 and no albumin, no sugar, considerable number of leucocytes and moderate number of bacilli. Phthalate test: 300 cubic centimeters of urine secreted in first hour, phthalate 50 per cent.

**Cystoscopy:** The bladder capacity 30 cubic centimeters, probably no residual urine. The prostatic orifice shows slight enlargement of both lateral and median lobes. There is no hypertrophy of the trigone and the ureteral orifices appear normal. A No. 6 catheter passes easily into each ureter without meeting any obstruction. Comparison: urinalysis right—smoky cloudy leucocytes none

red blood cells in moderate amount, no bacteria, urea 13 grams left—smoky cloudy, no leucocytes, considerable amount of red blood cells, no bacteria, moderate number of epithelial cells, urea 8 grams. Cultures from both sides sterile.

X-ray shows an oval calculus about 1 centimeter thick and 3 centimeters long in the region of the upper portion of the right kidney immediately back of the middle portion of the last rib, as shown in Figure. Pyelogram: thorium nitrate injected slowly by gravity (Fig. 1). This shows fairly normal pelvis, normal calyces in lower and middle portion of the kidney. The upper calyces are connected with the kidney by means of small openings which appear to be about one eighth of an inch in diameter and about one half inch in length. Above this small amount of thorium has penetrated to the region occupied by the stone, but no marked dilatation is made out, though somewhat irregular shadow indicates that the thorium has probably mixed with fluid in the sacular portion of the kidney.

**Impression:** We have here a case of calculus in the upper portion of the right kidney. This calculus is separated from the pelvis by marked narrowing through which it could not be extracted. It could be necessary to go through the cortex to remove it. The indefinite, irregular shadow indicates pus in the upper portion of the kidney and probably considerable destruction there. The excellent condition of the urine and the large area (four fifths that of the left side) show that the larger part of the kidney is probably sound. Therefore, it seems advisable to carry out the operation back of the stone and to remove the stone, if the operation considerable destruction of the portion of the kidney occupied by the stone is ended.

**Operation:** by Dr. Young. Gas, oxygen, and ether. Resection of upper third of right kidney. A localized pyonephrosis with calculus. Suture of cut edges with interrupted chromicized catgut sutures approximating raw surfaces. Gauze pack to the side of incision in front and beneath kidney. Wound closed with continuous chromicized catgut suture in 4 layers for the muscle and skin, closed with clips. Gauze and tube drainage. Upper angle. Only slight amount of hemorrhage. Condition excellent.

The kidney was exposed through an oblique curved incision which extended from above the last rib down and backward above the crest of the ilium. The muscles were divided and excellent exposure of the kidney obtained. As a result of a previous operation, there was a considerable amount of scar tissue and adhesions, but the kidney was finally freed. Examination showed



Fig. 2. Röntgenogram showing calculus in region of upper portion of right kidney.

that the ureter and pelvis were normal in appearance and the lower two-thirds of the kidney looked normal. The upper third of the kidney was irregular, cortex thin, and between this and the lower two-thirds of the kidney there was a distinct depression which somewhat suggested the appearance of double kidney. This portion of the kidney seemed to have a separate blood supply, but the pelvis was single.

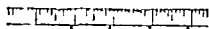


Fig. 3. Calculus found at operation.



Fig. 4. Pyelogram showing fairly normal pelvis, normal calyces in lower and middle portions of kidney. The upper calyces are connected with kidney by small opening.

Incision was made through the cortex, where it was very thin, to remove the calculus. A large amount of brownish material escaped, and along with this came the calculus which measured about 1 centimeter in diameter and 1.5 centimeters in length, as shown in photograph (Fig. 3). Investigation then showed that there was an irregular, sacculated condition of the upper third of the kidney with very little normal cortical substance, and that this connected with the major pelvis by a very narrow junction about 5 millimeters in diameter. Through this, instruments were gently inserted and no stone was detected in the pelvis or lower calyces. A flexible probe was also passed without difficulty through the ureter down to the bladder. It was then decided to carry out the operation of resection and this was done as shown in Figure 4. With a scalpel an incision was made through the cortex along the depression which indicated the demarcation between the healthy lower and the diseased upper portion of the kidney. There was moderate hemorrhage and clamps were immediately placed around the pedicle of the kidney so as not to include the ureter and pelvis. After this the resection was continued without difficulty. All vessels supply-



Fig 4 Incision being made through cortex of kidney showing method of resection

ing this upper portion of the kidney were ligated by means of a transfixation suture, and the diseased portion was removed in one piece. This revealed the inferior portions of three calyces, the rest of which had been completely removed. In the center was the opening which connected with the pelvis below. This was about 5 millimeters in diameter and consisted of normal-looking mucosa surrounded by an area of fatty tissue from 3 to 5 millimeters in width. The removal of this involved tissue produced a wedge-shaped depression in the kidney as shown in Figure 5. The mucous membrane was curetted thoroughly from the remaining portions of the calyces and the raw surfaces were drawn together by mattress chromicized catgut sutures, which were placed by means of a long, straight needle (Fig 5). When these sutures were tied a good approximation of kidney substance was obtained, except along the outer edge. By tying the loose ends to the ligations vertically across the outer edge,

complete approximation of the cut surfaces was obtained as shown in Figure 5. The rubber coated pedicle clamps were then removed and blood began to escape from the lower portion of the wound, but was controlled by a single additional stitch through the kidney substance in the depth of the wound. The hemorrhage was completely arrested, and the kidney was returned to its bed with a strip of gauze at the upper end and also in front and behind (this was probably unnecessary). The wound was then closed as above described, and the patient was returned to the ward in excellent condition. He received an infusion of 1500 cubic centimeters of salt solution. Pulse 90.

*Convalescence.* June 30. Patient has been doing well, highest temperature 100.5 degrees. Slight drainage of urine through gauze. One pack removed. June 3. Last pack removed. Slight bleeding. Temperature 100. Continues to drain urine through tube. June 17. Slight drainage of urine. Temperature normal. July 4. Tubes inserted for Dakin solution in sinus. July 7. Wound sterile. Looks



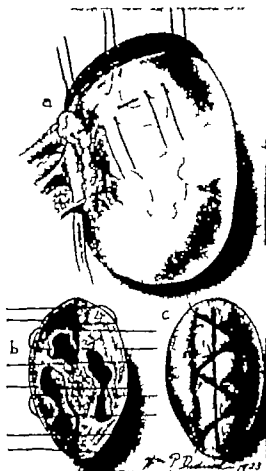


Fig. 5. Method of suturing and controlling hemorrhage of remaining part of kidney.

healthy, no organisms on examination for bacteria. Temperature normal July. Condition improving.

**Pathology.** The specimen consists of resected portion of kidney containing calculus which measures and centimeters and is irregular in shape and presents somewhat beaded appearance. The kidney substance removed measures 8 by 5 by 3.5 centimeters in size. The outer surface contains much adherent fat. Along the cut edge here the reaction was carried out the kidney varies from to 3 centimeters in thickness and presents an irregular surface with three cavities, each are continuous with dilated calyces. The intervening kidney tissue presents an unhealthy fibrous appearance. Section through the entire mass reveals series of irregular cavities, each communicating with each other and are evidently dilated calyces with cystic cortex surrounding them. Almost no healthy renal tissue is present except a point of resection. The mucous membrane of dilated calyces is somewhat irregular and in places granular and almost papillary.

**Microscopic report.** Four sections all similar. The kidney has everywhere slight round cell infiltration, with

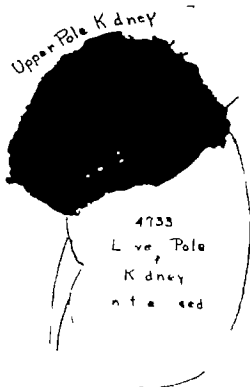


Fig. 6. Photograph of kidney specimen removed at operation.

moderate increase of nuclei in the glomeruli. In certain areas, along the vascular columns, the infiltration is much increased. There is some fibrosis, the tubules are compressed or destroyed and the glomeruli are hyalinized. In a few places are pockets of leucocytes, mostly mononuclear, with some polymorphonuclear forming small abscesses. Epithelial cells show arrangements, crescent, giant cells, or anything suggesting tubercles were. No tumor. In two or three tubules are found granular blue staining deposits with absence of epithelium suggesting intratubular calcareous deposits. The infiltration becomes more pronounced and diffuse near the pelvis, and to it is added marked vascular congestion but it remains predominantly mononuclear. Diagnosis: chronic pyelonephritis associated with calculus.

Our experience in this case seems to justify in every way the resection of a diseased kidney pole occupied by a calculus. I am confident that had we simply removed the stone and drained the upper portion of the kidney, convalescence would have been more tedious and the ultimate result would have been bad. As it is now the patient has as much healthy renal tissue on the right side as if a simple nephrotomy had been done and the chance of recurrence of stone has

been eliminated in this region and an opportunity to restore the urinary tract to normal has been furnished.

I believe this case justifies a much more radical method of attack in cases of stone in the kidney in which a part of the kidney is seriously injured and the remaining portion apparently healthy, particularly if the connection between the diseased portion of the kidney and the pelvis is small and the drainage from it therefore incomplete and unsatisfactory.

#### LITERATURE

Since carrying out this operation a hasty survey of the literature has been made to see whether anyone else has reported this method of attack in stone in the kidney. We have been able to find only one reference which is as follows:

Koenig, in 1919 reported the case of a young man of 17 who had symptoms of calculus for one year.

Urine as cloudy. X ray showed an enlarged left kidney back contained stone. Ureteral catheterization and X ray showed normal right kidney. On June 9, 1919, Koenig carried out an operation which he describes as follows: With lumbar incision, exposure of the left kidney as obtained. A stone in the upper portion was removed through the cortex, as also stone in the pelvis. Next, the atrophic upper pole was opened without

clamping the kidney pedicle. Evacuation, completely of a large stone from the pelvis, and lastly the removal of date-shaped stone. The pelvis was dilated. The contents were cloudy but not purulent. Below the ureter was free. Resection and suture of the upper atrophic kidney pole. Dilated pelvis reduced by sutures. Drainage of wound. Good result. September 1, 1919, examination shows small granulating wound. Urine still cloudy.

Koenig mentions in his brief report a case in which Kuester had carried out "resection of the kidney pole in a case of pelvic stone." Koenig's article is merely a short abstract of his report before the Aerztlicher Bezirksverein Wuerzburg and careful search of the literature fails to reveal any publication of the complete paper.

#### CONCLUSIONS

This case of renal calculus, in which the upper pole of the kidney was completely destroyed, and the lower two-thirds of the kidney healthy, shows by the good result following the resection of the diseased portion surrounding the stone that such an operation is simple, practical, and radically curative. I believe such cases are not uncommon and that resection may often be preferable to simple nephrotomy which leaves behind the sacculated, badly diseased portion which surrounded the calculus.

Kapitelstein und partieller Nierenresektion wegen Nierensteines. Munchener med. Wochenschr. 66, 1919, 720.

I have recently read Dr. W. E. Lee's description of a very similar operation in case almost identical with the one I have reported.

## INDICATIONS FOR INTERNAL SPLINTING OF THE SPINE

By PAUL B. MAGNUSON, M.D., F.A.C.S., CHICAGO

SINCE the introduction of internal splinting of spine by bone grafting, one method has been followed almost exclusively by the majority of men who do this type of work. This was described by Albee and is usually referred to as an Albee bone graft. The procedure followed by him consisted in splitting the spinous processes and laying a comparatively small piece of bone between the split halves of the processes and suturing it in place with kangaroo tendon. This, in time, provided the graft took and there was callus thrown out from the spinous processes, welded into a solid mass the spinous processes of the vertebrae covered by the graft. When this method is used it is necessary however to immobilize the patient for 6 months to a year before the graft can be relied upon to furnish any sort of sufficient mechanical support. This was the main objection to the operation. In other words, the patient must wear a plaster cast for many months following the operation, which it would seem should furnish mechanical support immediately, if properly done from a mechanical standpoint. It was to correct this fault that the procedure to be described was designed.

The ideal operation should (1) immobilize the spine immediately (2) relieve the pain (3) do away with the necessity of external support at least while the patient is in the recumbent position and be strong enough to allow the patient

to be up and around, in from 3 to 6 weeks, with only a support such as a Taylor spine brace applied. We believe that this has been accomplished in a sufficient number of cases at this time to warrant reporting the results.

Every patient, before any type of bone transplantation or other bone surgery is attempted, should be thoroughly and carefully gone over for any focus of infection which might metastasize to the site of operation.

The indications for this operation seem to be increasing as our knowledge of pathology of spine conditions increases. When it was first suggested it was recommended in the immobilization of high dorsal or cervical tuberculosis where a brace would not suffice to prevent deformity. As the evidence increases, however, it is found that even where braces are worn and the disease is not arrested with a reasonable degree of promptness, deformity gradually increases in spite of external support and it is our opinion that where proper technique can be applied and the general condi-



Fig. 1. Skin incision of sufficient length to expose all spinous processes to be included in graft. Skin flap turned back slightly beyond spinous process.

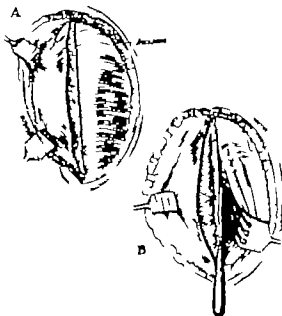


Fig. 2. A. Incision through fascia. B. Removing loose attachments with shell of bone from sides of spinous process and laminae.

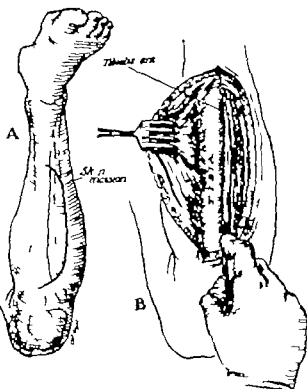


Fig. 3 A. Skin incision over anterior part of leg, with knee flexed, for the removal of bone graft. This incision should never be made immediately over the tibia because the skin flap is the only remaining tissue to cover tube after removal of graft. B. Incision between muscles and external surface of tibia preparatory to excision bone.

tion of the patient warrants immobilization of the affected segment of the spine by autogenous bone graft offers a greater possibility of cure than any other method of treatment, as well as the only reasonably sure possibility of preventing deformity regardless of the activity of the infection or the length of time it exists.

In one case in which a bone graft of this type was applied to a tuberculous spine the disease progressed until the bodies of three vertebrae were involved, the original focus having practically destroyed so far as the X-ray could determine, one entire body and a cold abscess pointed in the flank which was aspirated many times yet the individual developed no more deformity than was present at the time of the operation, had no pain, gained weight, and moved around in perfect comfort.

In compression fractures of the bodies of the vertebrae after having seen a very considerable number of cases treated in all kinds of ways, I

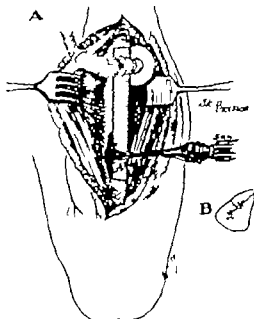


Fig. 4 A. Line of graft cut by circular saw. B. End view of bone.

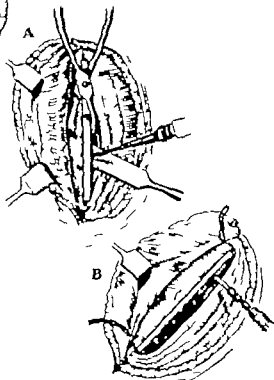


Fig. 5 A. Bone graft laid with cut surface of graft against raw sides of spinous process preparatory to cutting thread with tap and inserting ivory screw as in B. B. Screws in place reinforced with heavy braided silk sutures through graft and spinous process at each end of graft.

TABLE OF CASES

Case	Diagnosis	Previous	Age	Occupation	Reason for operation	Location of lesion	Length of stay in hospital	Condition of spine on admission	Time elapsed from injury to operation	Kind of immobilization after operation	Condition	Final result
1	Fractured 4th and 5th lumbar spine	M	29	Coal miner	Pain over 4th and 5th lumbar joints (continuous pain)	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton Taylor-Lamberton	Complete cure	Complete cure
2	Fractured spine	F	25	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
3	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
4	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
5	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
6	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
7	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
8	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
9	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
10	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
11	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
12	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
13	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
14	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
15	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
16	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
17	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
18	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
19	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
20	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
21	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
22	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
23	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
24	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
25	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
26	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
27	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
28	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
29	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
30	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
31	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
32	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
33	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
34	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
35	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
36	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
37	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
38	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
39	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
40	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
41	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
42	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
43	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
44	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
45	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
46	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
47	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
48	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
49	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure
50	Fractured spine	M	22	Coal miner	Continuous pain	4th lumbar joint	29 yrs	4th lumbar joint	29 yrs	Taylor-Lamberton	Complete cure	Complete cure

have developed the firm conviction that unless there is callus formation allowing the bodies of the vertebrae above and below to the one fractured within 3 months of the time of the injury and pain has disappeared at the site of the injury immobilization of this kind is indicated. Compression fractures of the body allow the vertebra above the fracture to change in the angle at which it lays on the fractured body and in its relation to the vertebra below and allows the inferior articular process of the vertebra above the fracture to slip up on the superior articular process of the fractured vertebra reducing the bony contact at the joint surface one half to two-thirds. This does two things. Allows more weight to fall on the ligament than if the bony contact were normal at the articular facet and throws the body weight forward. This further increases the strain on the ligaments. If this overstrain that goes on tenderness just below the kyphosis, the point of which is formed by the spinous process of the vertebra above the body which has been crushed.

Two of the four cases of immobilization done for rebel of fracture of the spine were coal miners and these two men after stability in one case of 14 months and in the other case 2 years and 3 months, were able inside of a year to return to work and their records at the mine show they average 13 tons per day and the other 15 tons per day and both say they have no pain in doing their work.

In case in which there has been a very marked compression of the body of one vertebra and the gibbus is sharp throwing the body weight at an acute angle forward above the site of fracture it frequently happens that pain develops not at the point of fracture but at the lumbosacral junction at which point there is an acute strain thrown on the muscles and ligaments of the lower lumbar region because the patient cannot stand erect but is forced to carry the body weight leaning forward. In such cases a bone-graft immobilization including the fourth and fifth lumbar vertebra and the sacrum is the only method of relieving this pain aside from the constant wearing of a spine brace of the Taylor pattern.

Subacute infections of the spine causing periostitis or osteo-arthritis, which is local, are also relieved by this internal splinting when the infection is localized to one segment of the spine. Constant backache and disability as a result of chronic relaxations of the lumbosacral ligaments have been relieved in three cases by this form of immobilization. An article, which is to follow, will deal more fully with the mechanics of this con-



Fig. 6

Fig. 6 Graft for tuberculous spine (Case 7 in table). Not lower end of bone graft riding up. Suture from spinous process of third lumbar. The braided silk suture is still holding. A complete cure and immediate relief of pain was established.



Fig. 7

Fig. 7 Bone graft between fourth and fifth lumbar vertebrae and sacrum to relieve constant pain site of

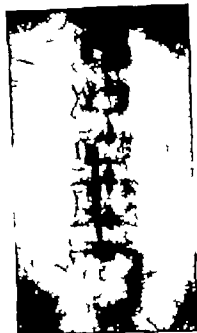


Fig. 8

fifth lumbar due to chronically relaxed ligaments, the result of fall. (Case 9 in table.)

Fig. 8 Anteroposterior view of Case 9. Note incomplete union of neural arch, first sacral and distorted neural arch at fifth lumbar. In this case the pain was undoubtedly due to lack of proper bony attachment for the strong ligaments supporting this region.

dition. Suffice here to say that the fifth lumbar vertebra, which acts on the sacrum at an angle of forty five degrees with the perpendicular and supports the whole body weight at this angle when the patient is in the erect position, is entirely dependent for its bony support on the angle at which its articular processes fit over those of the sacrum. If these processes do not articulate at such an angle as to prevent the forward displacement of the fifth lumbar on the sacrum, as is frequently the case, then all the support must be borne by the lumbosacral ligaments.

In one case which was immobilized by this method, the fifth lumbar vertebra was so movable that the spinous process could be grasped by a long-jaw forceps and the fifth lumbar could be moved back and forth on the first sacral for an almost unbelievable distance and without impinging on the cauda. This condition was caused by chronic relaxation of the ligaments and the fact that the articular facets impinged upon each other in almost an anteroposterior plane which took away the support which in

the normal individual prevents the fifth lumbar from slipping forward on the sacrum where they are set at an angle of forty five degrees at least with the anterosuperior plane.

#### TECHNIQUE

A curved incision is made of sufficient length thoroughly to expose all the spinous processes to be included in the graft. This flap is held back to the side of the spinous processes farthest away from its convexity and the incision then protected by towels fastened to the edge of the wound. The heavy fascia covering the erector spinae muscles is then split, close to the side of the spinous process best exposed. With a very sharp penosteal elevator or the edge of a wide chisel the erector spinae muscles and the periosteum with a thin layer of bone attached are separated from the side of the spinous processes and the posterior surface of the laminae. This leaves, of course a layer of bone and periosteum with an interrupted blood supply from the muscles, attached to the muscles and laying away to one side. The



Fig. 9. Lateral view of curved bone graft taken from anterior surface of tibia. Fracture of the spine with subsequent infection (Case 1). Three ivory screws and two heavy braided silk ligatures. The deformity was so great in this case that straight graft could not be applied. Not shape of graft removed from anterior surface of the tibia.

Fig. 10. Anteroposterior view of Case 1.

muscles then, with the periosteum and shell of bone are well retracted and the sides of the spinous processes exposed are thoroughly cleaned and left raw; the outer shell, if possible being removed with the muscle, but if not completely removed with the muscle, removed subsequently. This leaves a raw surface of bone upon which to apply the sawed surface of the graft to be taken from the tibia.

The length of the graft to be used is then measured with calipers; this usually includes two spinous processes above and two below the injured or diseased vertebrae. The leg on the side of the operator is flexed, having been prepared previously and a curved incision made with the can entry over the anterior tibial muscles. The flap is reflected and the tibia exposed. A line of incision is marked out on the periosteum, the periosteum pushed back, and a piece of bone measuring the necessary length, usually about 5 to 6 inches, in the adult, and one-half inch wide and one-quarter inch thick. Holes are drilled at the corners of this proposed graft and these holes connected by single blade of a small circular saw. The piece of bone removed is transferred to the spine and fitted in place. It may be necessary

to curve the graft somewhat to conform with the deformity which exists in the spine if any. This is possible with a small circular saw and does away with the necessity of cross cutting the graft to bend it, which necessarily weakens it. The widest sawed surface of the graft is laid perpendicular; the rough surface of the scraped spinous processes and the sawed narrow edge of the graft then come in contact with the posterior surface of the scraped laminae. When the wound is sutured, this leaves two sides covered by periosteum in contact with the muscles on the side and back. The graft is held in position by forceps while holes are drilled through the graft and the middle of each spinous process. Wherever it is possible an ivory screw is put through the graft and into the spinous process. This is sometimes difficult to do in all the processes, but can usually be accomplished in at least two, which gives two very firm points of fixation. The screw does not necessarily have to go in exactly horizontally; it can be put in at the most convenient angle so long as it passes through the process and the graft. The graft is fastened to the other processes by means of heavy braided silk sutures passed through the hole in the graft and spinous

process and up as close to the opposite side of the spinous process as possible. These sutures are double one suture being tied around the upper half of the spinous process and the other one around the lower half of the spinous process which gives very strong bridgework support the graft being fastened through five holes tightly to the spinous processes allowing no motion between any of them and immediately fixing the spine in this position. Braided silk is used instead of kangaroo tendon because of its lasting support and non irritating quality. No trouble has been experienced with it in any clean bone case. The muscles are replaced and the fascia very carefully sutured to the interspinous ligament this also adds strength by covering the graft with a very firm and supporting structure. The skin is closed and the ordinary surgical dressing applied. The patient is returned to bed without other fixation, and is kept in bed until all soreness as a result of the operation has disappeared. He is then fitted with a Taylor spine brace with wide supports on each side of the spine which do not impinge on the graft, and allowed to be about. The brace is worn from 6 months to a year as may be found necessary.

#### CONCLUSIONS

A heavy bone graft is much preferable to a light one because it may be fastened to the

spinous processes in such a way that it will give immediate immobilization, immediate relief from pain, and do away with the necessity of uncomfortable body casts, and allow the patient to move freely in bed and to assume the upright position within 3 weeks of the time of the operation.

2 The ivory screws inserted through a heavy bone graft into the spinous processes make a firmer and stronger fixation immediately than any other device. Heavy braided silk where it is not possible to use ivory screws makes a firmer and more constant fixation than does kangaroo tendon or catgut, and does not cause any more irritation of the tissues than do these other materials.

3 This type of fixation of the spine should be done wherever chronic disabling pain and increasing deformity exists as a result of the following conditions:

- a Tuberculous of the spine
- b Tuberculous canes of the bodies of the vertebrae
- c Fracture of the spine—(1) compression of the bodies, (2) fracture of the articular processes.
- d Forward slipping or relaxation of the fifth lumbar vertebra
- e Chronic strain with relaxation of the ligaments where there is malformation at the lumbosacral articulation with disabling backache.

## A NEW TYPE OF MATTRESS PARTICULARLY ADAPTED FOR USE IN CASES OF RECTAL INCONTINENCE

By JOSEPH FRANKLIN MONTAGUE M.D. NEW YORK

Rectal Clinic, University and Bellevue Hospital Medical College

**D**URING the recent war I had occasion to treat many cases which presented an urgent problem in nursing. These were cases in which the patient was either bed-ridden or was incontinent of feces or urine or both. The inadequacy of the ordinary hospital mattress in this type of case is familiar to anyone who has been burdened with the care of patients of this type. Even with the most conscientious nursing care it is almost impossible to keep these patients clean and comfortable. Painful bed sores or torturing eczema of the perineal or gluteal regions is prone to occur and add much to the misery of the sufferer.

All in all the nursing care of such conditions has always been a most disagreeable assignment and the fact that such may with the use of the

type of mattress I suggest, be handled with comparative ease and infinitely more comfort to the patient I am sure will prove pleasant news. Besides a genuine pity for the poor unfortunates so afflicted, I have always had much sympathy for the nurses who must attend such troublesome and, needless to say, messy cases.

Working in conjunction with Miss Anna Scanlan, R.N. of the Bellevue Training School, I finally decided upon a design of mattress which has been used with much satisfaction in several large hospitals in New York City and not a few private homes. It may be described briefly as follows:

In size and general appearance the mattress devised resembles an ordinary single bed mattress. This fact increases the range of utility for it may





Fig. 1 Shows the recess in the mattress with the receptacle in place



Fig. 2 Shows the mattress complete after removing receptacle and replacing the sections

be used on any bed or any spring. It differs, however, from the ordinary mattress in possessing a recess built into the center of the mattress to accommodate an excretory receptacle (Fig. 1). This recess is filled by such receptacle and a mattress section or by two mattress sections depending on whether the use of one or the other is required. With the two sections in place the mattress may be used as an ordinary one (Fig. 2). When the receptacle is in use the recess and the mattress for about one foot around is covered with rubber cloth. This is done to protect the mattress in case of accidental spillage of excreta though this, with ordinary care, seldom occurs. The patient is made absolutely comfortable by lying on a rubber ring, cushion or pneumatic horsehoe which is placed on the bed pan or douche pan. The latter has appeared preferable in many instances.

When one wishes to change the pan and replace it with a clean one the patient merely half turns and the outer section is withdrawn. The soiled pan is then replaced by a clean one which is held ready. When the outer section is replaced, the patient is allowed to roll back. In a few seconds, therefore, without the slightest exertion on the part of the nurse, the bed pan may be changed under the heaviest of patients.

In cases not incontinent this type of mattress, because of the depressed position of the pan, allows natural excretory function without disturbance to the patient. This for instance, in case of pneumonia is a matter of prime importance because the strain attendant upon the use of a bed pan on the level type of mattress throws a decided and undesired strain upon the heart, with danger of producing dilatation. Likewise in a case of apoplexy where any exertion causes an increase in blood pressure with a consequent risk to the patient, the great comfort and ease of evacuation which attends the use of the

mattress I have described, insures safety. To mention one more instance, there are cases on record—in a postoperative case with a laparotomy wound—in which the strain put upon the sutures of a fresh laparotomy wound by attempts to use a bed pan on the level type of mattress has resulted in an opening of the wound and an extrusion of the intestines. Why such a catastrophe does not occur more often is a wonder to me when I observe the great strain put upon the wounds by the extreme extension required in the use of bed pans on ordinary mattresses. Needless to say all such strain is avoided by the use of a mattress such as I suggest. Besides the uses mentioned, it can be well utilized in procuring specimens in difficult cases, for giving enemas, for catheterizations, for giving high colonic irrigations, in obstetrical cases and in those psychopathic cases that need continual restraint. It is also of great value in cases where plaster casts are worn over a period of time.

The use of the mattress devised has proven most efficient in every respect. It is infinitely more comfortable and cleanly for the patient, and evacuations are a matter of comfort and ease. From the standpoint of the nurse, the ease with which cleanliness is maintained and the patient's excretory wants attended to, the device is particularly attractive. Linen is not soiled as quickly nor are the frequent changes of linen required as with the ordinary type. This economy of time and effort of the nurse leaves her free for the performance of other duties.

In conclusion, I believe it may be modestly said that the mattress herein suggested has passed the experimental stage. It has been used with much satisfaction in several large hospitals in this city. In private homes it has also met with flattering commendation. I sincerely believe the management of bed patients is decidedly aided by this device.

THE TREATMENT OF GONORRHOEAL ENDOCERVICITIS BY HEAT<sup>1</sup>

BY BUDD C CORBUS, M.D. F.A.C.S. AND VINCENT J O CONOR, M.D. CHICAGO

EVER since Moses (1) lead his children out of the wilderness, the human race has been afflicted with gonorrhea and during all this time, the female genital organs have suffered not only from the effects of the gonococcus but almost as much from the many methods that have been suggested for their relief. In a large measure, this has been due to the anatomical structures affected and to the lack of a definite knowledge of the pathology of the female urogenital tract following the acute stages of gonococcal infection. It is unnecessary to review the many methods which have been tried for the relief and cure of this stubborn infection. It is well known that a large percentage has failed to effect a cure because of the obtuseness of the endocervicitis and the inaccessibility of the maculae gonorrhoeae to topical applications. Therefore, it is not surprising that surgery as a final resort has been so often employed in an attempt to clear up this chronic infection.

#### RECENT WORK EMPHASIZING THE MINOR RÔLE PLAYED BY THE TUBES AND ENDOMETRIUM IN KEEPING UP ENDOCERVICAL INFECTION

Curtis (2) and others, in investigating the bacteriology and pathology of the fallopian tubes removed at operation, have shown that chronic endometritis, as a clinical entity is very uncommon, and that persistent infection of the endometrium seldom exists unless maintained by other lesions, such as cervicitis or cellulitis.

The corporal endometrium tends to remain free from chronic infection. Histological examinations and cultures from cervixes obtained at operation have revealed that bacteria frequently lodge in these tissues especially in the vicinity of the actively secreting glands of the mucosa. It has been found, also, that granulations and strictures are often present in the canal of the cervix. It has rarely been possible to obtain gonococci in cultures from thoroughly ground fallopian tubes removed from patients who have been free from fever and leucocytosis for a period of 10 days or 2 weeks. The fallopian tube, therefore can hardly be considered as a focus for perpetuating a chronic gonorrhoeal infection of the cervix. Persistently active gonorrhoea of the tubes is evidently ascribable either to recurrence of infection from without or repeated invasion of

bacteria from the chronically infected lower genital tract.

If the patient can be early isolated from the source of the infection a single attack of gonorrhoeal salpingitis is usually borne without protracted clinical symptoms or severe pathological results. In a series of three hundred patients with evidence obtained by the histories, examination of the external genitalia, and operative findings combined with laboratory studies, it was ascertained that the gonococcus was responsible for 70 per cent of the cases.

Further investigation (3 and 4) comprising a combined bacteriological and histological study of the endometrium in health and disease, has shown that chronic endometritis, *per se* with bacteria present in smears or cultures, is practically to be ruled out as a clinical entity.

The gonococcus is most frequently found, because it is the infectious organism most often brought in contact with the cervix. Since chronic infections of the corpus uteri are as a rule secondary to infections in other pelvic organs, intra-uterine treatment has little value because the focus of infection is not within reach. The discharge that is the most infectious and persistent comes from the endocervical glands. It is here, that treatment must be directed as the gonococcus localizes in the glands of the cervix and endocervix and is the predisposing cause of a chronic purulent discharge in a large percentage of women who have not borne children and the predisposing cause many times of leucorrhoea in women who have borne children. Any method of endocervical treatment which will destroy the gonococcus and at the same time cause only a minimum impairment of tissue, should be an ideal way of curing this troublesome and chronic infection.

#### THE USE OF HEAT TO DESTROY THE GONOCOCCUS

The application of heat as a therapeutic measure in the treatment of neisserian infections in the male is not new. Heat applied to an arthritis of gonorrhoeal origin has long been an accepted and valuable therapeutic agent.

The different forms of psychrophores designed both for urethral and rectal application of heat and cold are familiar instruments in the armamentarium of many surgeons.

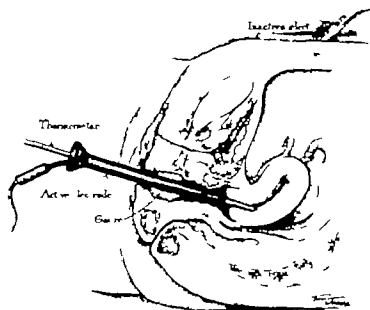


Fig. The inactive electrode is across just back of the symphysis pubis, separated from the skin by gauze pad. The cervical thermophore comprises the active electrode. By means of the diathermy current the heat is passed between the two electrodes, the active electrode being the smaller, becomes the hottest. The thermometer that passes into the core of the instrument registers the temperature of the electrode.

In 1913 Fulton (5) called attention to the use of heat applied to the urethra by running hot water through a modified psychrophore. This instrument had thermometers attached so that a definite temperature could be maintained within the urethra. The results in a small number of cases were excellent but his instrument was too cumbersome. Vorner (6) tried curing the gonorrhea in a similar way but heated his "double sound" by a magnesium lamp. In order to solve the problem in another way Weiss (7) keeps the patient in a hot bath until the entire body is raised to the required fever temperature. In this way he artificially induced fever. In eleven cases of recent gonorrhea, he had the patient take hot baths for periods of 40 to 45 minutes during which time the temperature of the water was gradually increased from 104 degrees F (40 C) to 110 degrees F (43.5 C). In one case, the body temperature was raised to 108 degrees F (42.2 C) in a 40 minute bath and at once the gonococci entirely disappeared from the urethral discharge.

Many workers have tried to elaborate on the psychrophore. Others, including one of us (Corbin, B. C.) have tried to construct a heated

sound. Its use has been quite popular among the German urologists. The reports published by Frank (8) Rost (9) Kyaw (10) and Scharff (11) are quite interesting. Previous to this time, these different methods of applying heat have been confined to infections of the male urethra, but for the most part have failed because of the difficulty in maintaining a fixed temperature in a structure so vascular.

*The resistance of tissue to different degrees of temperature*—In order to determine the effect of different degrees of heat on the mucous membrane, Santos (5) inserted the positive electrode into the urethra of dogs and heated the instrument to 113 degrees F (45 C) for one hour. No distress was apparent during the entire treatment. The dogs were sacrificed after 8 days, and grossly the urethra showed no abnormality. In comparing the heated and unheated segments microscopically there was merely an epithelial desquamation in the heated portion.

Santos further experimented on himself and others. He states that up to 109 degrees F (43 C) nothing abnormal is felt within the urethra, but starting at 109.4 degrees F (43 C) there is a gradual

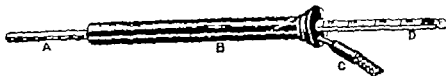


Fig. 1

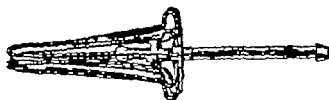


Fig. 3

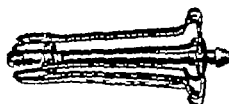


Fig. 1 The Corbus cervical thermophore. The instrument consists of a very thin nickel-silver shell A closed at one end and measuring 5 millimeters in diameter. A hard rubber sheath, or covering, B measuring 5 centimeters in length and one centimeter in diameter is attached, thus allowing an extension of 4 centimeters for insertion into the uterus. An insulated terminal, C is provided for attachment of the cable supplying current. A thermometer, D is inserted to the full depth of the shell and reading taken from the exposed portion. It has been found that the

greatest accuracy is necessary in constructing the instrument to insure its proper performance. Any small diathermy machine capable of supplying 800 to 1,000 milliamperes will produce heat enough to apply the thermophore.

Fig. 3 The wire bath speculum. The instrument as it should be when inserted. Under no consideration is the patient allowed to insert the speculum unless lying flat in the bath tub. The instrument with plunger pushed forward thereby giving the maximum effect of the Hot Sets Bath.

sensation of warmth and this is increased to a point of intolerance at 114.8 degrees F. (46 C.). He has kept the urethra heated to 113 degrees F. (45 C.) for one hour without the slightest tissue destruction.

**Therapeutic possibilities.**—We must accept the fact that gonorrhea persists in women largely because of the continued presence of the gonococcus in the para-urethral, the cervical, and the endocervical glands. Frequently the continued application of locally effective germicidal agents will bring about a complete disappearance of the gonococci in these structures. But in a great many women treated by douches and local applications, the gonococci remain securely in the depth of the endocervical glandular tissue. A germicidal agent is therefore needed, which will penetrate the active foci. From the foregoing, it must be clear that heat constitutes the most ideal gonococciocide, provided it can be induced into the depths of the tissue and so controlled that it will destroy the infection and leave the normal tissue unharmed.

In an effort to accomplish a cure in these cases we have utilized the well-established fact that the gonococcus is instantly destroyed at a temperature of 113 degrees F. (45 C.) and also that prolonged exposures of some but lesser degree gradually bring about its disintegration. We further have found that it is possible to maintain a tempera-

ture of 116 to 117 degrees F. (46.5 to 47.5 C.) within the cervix for 40 minutes without causing pain, discomfort, or tissue destruction.

With the advent of the more powerful high frequency machines it has become possible to get heat into "the depth of the tissue" by diathermy. Geyzer (12) and Santos (16) have reported unusually favorable results from the application of induced heat to the male urethra, but it seemed to us that they were unable to measure accurately the degree of thermopenetration.

It occurred to us that an instrument could be devised so that the active electrode would fit the cervical canal and at the same time enable us to control the temperature by a most simple and easily applicable method.

#### DESCRIPTION OF THE CERVICAL THERMOPHORE

The thermophore, as devised by one of us (Corbus B. C.) consists of a very thin nickel-silver shell, A closed at one end and measuring 5 millimeters in diameter. A hard rubber sheath, or covering, B measuring 15 centimeters in length and 1 centimeter in diameter is attached, thus allowing an extension of 4 centimeters for insertion into the cervical or urethral canal.

An insulated terminal, C is provided for attachment of the cable, supplying current. A thermometer, D is inserted to the full depth of the shell and reading taken from the exposed portion.

It has been found that the greatest accuracy is necessary in constructing the instrument in order to insure the proper temperature regulation.

Any diathermy machine which is capable of supplying 800 to 1000 milliamperes will produce heat enough to supply the thermophore.

#### TECHNIQUE

The patient is placed in the lithotomy position. It is well, but not entirely necessary, to have the table covered by a rubber pad. The indifferent electrode 4 by 6 inches in size is made of black tin. This is placed over the suprapubic region with a gauze pad saturated with hypertonic salt solution imposed between the electrode and the skin. The gauze must be kept moist during the entire treatment. A vaginal speculum having been inserted, all mucus, pus, and debris is removed from the cervical canal and vagina by alkaline sabs. The active electrode (cervical thermophore) is then placed in the cervical canal and anchored to the speculum to insure its being held in place. The contacts are made and the current gradually turned on. Care should be used in watching the rise of temperature as indicated by the thermometer. The thermophore should be kept under constant attention during the entire treatment.

When the thermometer registers 164 to 170 degrees F (46.5 to 47 C) the current is stabilized and this degree of heat is continued for 30 to 40 minutes. The treatments are repeated every week or ten days. The treatment is absolutely painless as evidenced by the fact that many fall asleep during the session.

Following this treatment the cervical discharge changes very rapidly from a thick purulent to a thin watery character and cervical erosions rapidly heal. In the interim between treatments, a wire vaginal bath speculum is inserted by the patient herself two or three times a week. She then remains in the hot bath for one half hour. The heat of the water should be gradually increased from 100 to 110 degrees F (37.8 to 40 C).

Infection of Skene's or other urethral glands call for separate consideration. It must be distinctly understood that this form of treatment in no manner replaces surgery, where surgery is indicated. Bartholin gland abscess, fistula, salpingitis or pelvic abscess call for the usual surgical consideration.

#### CLINICAL RESULTS

Realizing that any claims for a permanent cure of gonorrhea in women must be based upon a long continued observation, we have withheld

this report for a period of 4 years. During this time we have had the opportunity of repeatedly examining many of these patients and have thus been able to satisfy ourselves that this method brings about a complete and permanent elimination of the gonococcus.

Thirty-five women have been treated by this method. Of this number eighteen have been observed repeatedly during the past 3 years. Twenty-two had been checked for 3 years. The remainder disappeared after the cessation of active treatment and were not available for observation after the 3 month period following the application of their discharge technique.

Our routine has been to study microscopically the cervical discharge coincident with each heat application. The treatments are continued until the gonococcus has been absent from five successive smears. The patient is then instructed to return twice monthly for examination of the cervix and urethra. One of these examinations is made 48 hours after the cessation of the menses. If no gonococci are found during the first 2 months an endocervical application of 5 per cent silver nitrate solution is made and smears obtained twice during the week that follows. If these are negative, the patient is declared well.

It should be emphasized that three negative cervical smears taken in quick succession after cessation of a given method of treatment do not justify the assumption of a permanent cure.

In twenty-two carefully studied cases, the gonococcus disappeared permanently from the cervical discharge as follows: after one treatment, five cases; after two treatments, seven cases; after three treatments, four cases; after four treatments, six cases; after seven treatments, four cases. The fewest treatments given in any individual case were four and the most fourteen.

Four of these twenty-two women have married, borne children and yet showed no sign of recurrence.

#### CLINICAL APPLICATION

This method is contra indicated during pregnancy in the early acute stages of the infection or when evident active pelvic inflammatory changes such as salpingitis or pelvic cellulitis are present.

The most pertinent point about this method of treatment lies in the fact that its application entails painstaking co-operation between patient and physician, slightly more prolonged office treatment than is usual, and sufficient intelligence on the part of the patient to realize the importance of getting completely well.

For these reasons we have been able to apply this method only to private patients of the more

intelligent class. Under proper supervision it might be applied to institutional or dispensary practice.

#### SUMMARY

A method for curing gonorrhoea, when the latter is localized in the cervical canal in women by heated electrodes has been far more successful than any previously tried technique.

It is necessary accurately to control the temperature within the cervix if we expect to get an exact distribution of heat.

The method is painless and devoid of medication. Strictures and cicatrices are avoided.

This report is based upon clinical evidence of complete cure covering a period of from 2 to 4 years observation.

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# EDITORIALS

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## SURGERY, GYNECOLOGY AND OBSTETRICS

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FRANKLIN H. MARTIN, M.D.  
ALLEN B. KAMAVEL, M.D.

Managing Editor  
Associate Editor

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JANUARY 1924

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### THE NATURE OF CANCER

IT has always been the case that in the search for theological or philosophical truth the more difficult the solution the more fascinating the problem and since there is a little of the philosopher and perhaps of the theologian, in every properly equipped medical man, it is small wonder that regardless of rebuffs, the hitherto impenetrable secret of the nature of cancer should absorb so much of our attention.

Ever since theological theories of disease have been abandoned in favor of purely physical ones, there is no single question to which more thought has been devoted, or on which greater effort has been expended and certainly none in which thought and effort have met with less real success. It was once said by a great preacher that the path of science is strewn with the bleached bones of dead theories and we may well accept the figure as applicable to our tussles with the nature of malignant disease.

But if the past has been barren of success, there is no reason for assuming sterility in the womb of the future and it may confidently be stated that our efforts will not cease until the problem is solved, even if the inducement

were to be only knowledge for knowledge's sake. But with such a glorious reward for success as the relief of human suffering by ridding humanity of a scourge and old age of a terror the duty of perseverance is paramount.

It would be folly to surmise the when and the how. It may be that a new method may first have to be discovered or invented that will bear a similar kind of relationship to the elucidation of the problem, that let us say the method of staining bore to the study of tissue structure, or the method of culture to the study of bacteria. In the meantime we must possess our souls in patience in sure and certain hope that the mystery will not forever lie hidden but will yield its secret, as other mysteries have done. Malaria and yellow fever once looked equally baffling, but their riddles have been read by the genius of inspired investigators.

But though the key to the nature of carcinoma is still hidden, we know something of its ways, and the conditions which favor it a thing of no small value from a practical standpoint, for though such knowledge cannot be said to command its prevention, it certainly shows how to lessen its incidence, a very real if not a very dramatic gain.

The known conditions favoring the appearance of cancer may be summarized under two heads first, lowering of tissue vitality and next, local irritation. Old age is certainly a predisposing factor. It is assumed that this predisposition is due to a process of devitalization of the tissues, which after middle age goes on *pars passim* with the tacking of the

clock. At first blush it would seem that here we have nothing to discuss—old age, however deplorable, being inevitable. This is of course true and yet time affects different people so differently that it amounts to a blunder to estimate a man's age merely by counting his years. Some men are older at forty than others at seventy and even octogenarians have been known to keep pace in all essential matters with men who might be their grandchildren. That indefinite combination of qualities known as a man's constitution and the care he takes of it, are the real factors which determine the rate at which his tissues become devitalized.

Among the more avoidable causes of lowered vitality affecting the body generally and no doubt each cell particularly syphilis and the abuse of alcohol are usually conceded first place. But potent as these factors are, even when combined, they do not appear to be sufficient to cause malignancy without the aid of some local influence. Of these local influences the only ones at present recognized fall under the head of irritation. The variety seems of lesser importance. It may be mechanical, chemical, bacterial, or thermal. Smoker's lip is an example of the mechanical form, one fast disappearing with the clay pipe. We are familiar with chemical examples in tar and phenol workers. Bacterial has its best example in the mouth, where a filthy state of the teeth due to prolonged neglect of the toothbrush is so commonly found in association. Thermal irritation has not yet received as much attention as it appears to deserve. The most usual seat is the mouth and throat, owing to the vicious and unnatural practice, especially among women, of ingesting superheated food, and particularly tea. There is a strong suspicion that the greater frequency of post cricoid carcinoma in women may be due to this cause.

But every one of the concomitants, which from their association with malignant disease we have come to regard as factors either in predisposition or determination may be conspicuous by their absence and yet the disease mocks our explanations by its appearance. We must then confess to being once more in front of the big black wall that turns us back to the precise point whence we started.

Myself when young did eagerly frequent  
Doctor and Saint, and heard great argument  
About it and about but evermore  
Came out by the same door where in I went

ROBERT WOODS

### CHOLECYSTOSTOMY VERSUS CHOLECYSTECTOMY

CHOLECYSTOSTOMY versus cholecystectomy although a trite subject, is not a stale one. If the gall bladder alone is affected, the patient is better off without it. Patients on whom cholecystostomy was performed for gall stones many years ago, some of them 25 years ago appear with a new formation of gall stones. Cholecystostomy has been performed more than twice on several such patients with return of stones. Gall bladders containing two entirely different kinds of stones so different that it is apparent they formed at two distinct periods, are occasionally encountered.

The function of the normal gall bladder probably is not very important, but certainly those who have had the experience of examining the gall bladder following cholecystostomy and finding it bound to the abdominal wall and adjacent viscera with a mat of firm adhesions, can hardly conceive of such a gall bladder functioning. Cholecystostomy therefore is not conservative, because conservation means maintaining function. After cholecystostomy the patient is expected to be symptomatically relieved for a time at least,



possibly for all time. Although cholecystostomy is not truly a conservative operation the condition of the occasional patient is such as to make it safer from an operative standpoint than cholecystectomy, as in very obese patients or patients with serious constitutional maladies. It is better in the occasional case to perform cholecystostomy with the possibility of having to reoperate than to risk losing the patient with a more radical primary operation.

If the infectious process is no longer confined to the gall bladder but has extended down into the common duct, and from there to the hepatic or pancreatic ducts, the whole aspect of the case is changed for the worse and cholecystostomy rather than cholecystectomy is now the logical procedure. Once the deeper ducts are involved in an infectious process who can foretell the ultimate result? If cholecystectomy has not been performed secondary operation on the common duct is comparatively easy in the absence of the gall bladder. It is difficult and dangerous. In cases of obstruction beyond the cystic duct causing biliary obstruction, as in chronic pancreatitis which sometimes occurs subsequent to operations on the common duct cholecystogastrostomy or cholecystoduodenostomy afford excellent result. Why burn our bridges by an ill advised cholecystectomy?

Chronic relapsing pancreatitis secondary to gall-bladder infections without jaundice however eventually may require cholecystectomy for cure. cholecystostomy affords relief only so long as there is drainage to the surface of secretion from the gall bladder containing bacteria which have become acclimated to the pancreas, and reinfect it when external drainage ceases.

If the biliary ducts become infected stones may form in the ducts, not the faceted stones

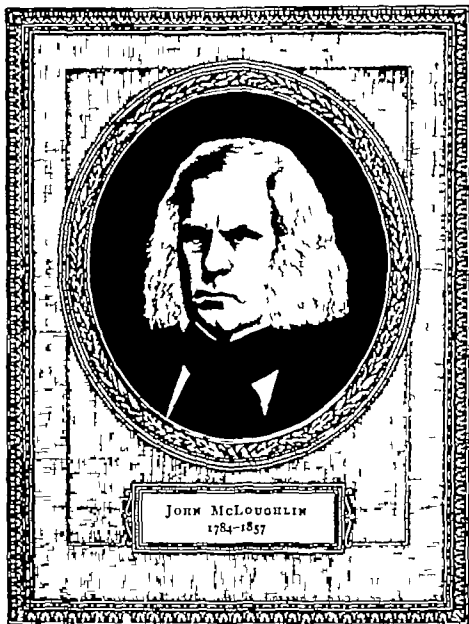
such as form in the gall bladder but rounded, disk or cartridge shaped crumbly stones, composed of greenish black bile pigments. Stones originating in the hepatic duct may drift down into the common duct from time to time requiring repeated operations for the cure of the patient. I have seen several such patient who were cured after having stones removed from the common duct three times.

In cases of biliary cirrhosis of the obstructive type of Adams caused by infectious extending from the gall bladder to the minute ducts of the liver prolonged drainage of bile to the surface with complete removal of bile tension by cholecystostomy sometimes initiates a degree of improvement which enables the patient to work in fair health for years. While not completely cured at least he is not dead.

Walters in his work on the pre-operative rehabilitation of the blood of the jaundiced patient, brought out a fact of great importance. He found that a higher mortality followed cholecystectomy with removal of stones from the common duct in the jaundiced patient than cholecystostomy and that, in 58 per cent of jaundiced patients who died following combined choledochotomy and cholecystectomy there was too much blood in the abdominal cavity not always enough to cause death but sufficient to be a contributing factor. The blood pressure in the portal circulation normally is only 30 millimeters, in the general circulation approximately 130 millimeters. In the jaundiced patient the back pressure of the obstructed portal circulation causes prolonged and perhaps fatal continuation of hemorrhages owing to slight traumatism of the liver which in the non-jaundiced patient would have no significance.

W. J. Mayo

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# MASTER SURGEONS OF AMERICA

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JOHN McLOUGHLIN

FATHER OF OREGON'

**S**URVEYING the surgical field in America exhibits a striking picture that best reveals the history of the surgical forces that have played an important, if not controlling part in the development of American nations.

The history of surgery in the northwest is forever linked with the growth and progress of the west. The surgeon accompanied the fur traders and were among the first to enter this vast unknown region. They witnessed the transformation of our American deserts and forests and Canadian prairies into healthful and flourishing commonwealths.

There are few chapters in the history of surgery more interesting than those which record the pioneer work done by the surgeons of all parts of America and none more fascinating than the niche made by Dr. John McLoughlin, one of the unique characters of our great northwest.

John McLoughlin was born October 19, 1784, in Canada, about one hundred and twenty miles below Quebec. His father was John McLoughlin, a native of Ireland who was accidentally drowned leaving seven children. John and David were the only boys. Their only maternal uncle was Samuel Fraser, M.D., who was doubtless a factor in both boys becoming interested in medicine. David loved the sea and after graduation joined the British Navy. John was educated in Canada and Scotland. He loved the woods, rivers and rolling prairies. It was doubtless the same spirit that lured Dr. Wilfred Grenfell to a life of sacrifice in far-off Labrador. It was the same spirit that prompted Dr. William Beaumont to buy and borrow his patient, St. Martin, and travel from country to country in the interest of pure science.

Dr. McLoughlin had an impressive personality, physically perfect, his very presence blending to an atmosphere of culture, a well shaped head and face, a mouth, the mark of indomitable courage, lips that softened and whispered words of encouragement to the sick and needy. However, we are told that at Fort Vancouver Dr. John McLoughlin lived and ruled in a manner befitting the chief of the western empire, but always with a graciousness and courtesy becoming a man of his profession and representative of the Hudson Bay Company.

He was brave and fearless and was absolute master of himself and those under him. He put a stop to the sale of liquor to the Indians. There were no Indian wars in the Oregon country during the entire period of McLoughlin's administration from 1824 to 1846. Dr. McLoughlin founded the first hospital of the great northwest. He provided food and shelter and gave surgical attention to thousands of sick and helpless. His benevolent work in this hospital was confined to no church, sect, or race of men but was as broad as suffering humanity. In one corner was a patient, a trapper, who had lived close to nature for years, hunting and fur trapping among the mountains, valleys, and streams. Recently while on duty as a trapper and also as a soldier protecting the settlers and immigrants from the savages, he had been wounded. His wounds were dressed and he was resting comfortably in the shed, slab covered hospital of the wilderness. In another corner was an Indian mother and by her side, her little child, the only survivors of a once populous Indian village. The recent epidemic of influenza, that brought sorrow and suffering to nearly every home, can be compared to the epidemic of 1829 according to Snowden, which, supposed to be the ague, broke out among the Indians along the Columbia and for three or four succeeding years raged with peculiar virulence. It is reported to have been more fatal among the tribes than even the smallpox had been. During the first summer after the disease in some of the villages there were not enough living left to bury the dead. Those already afflicted fled to the sea coast, abandoning the dead and dying to the birds and beasts of prey, some of the villages being entirely deserted. Canoes were drawn up on the shore, fishing nets were abandoned where they had been left, spread upon the trees to dry and all the houses were left tenantless. The dogs were left, but no other living thing gave evidence that the place had been inhabited. Here among the poor, the injured and afflicted with pestilence, worked John McLoughlin.

His diagnostic and surgical ability were eclipsed only by his ability as a statesman. When the bar sinister of propaganda caused discontent among the fur trading companies and disputes arose relative to the boundary line between Great Britain and the United States and war seemed inevitable, it was then that Dr. McLoughlin put out the smouldering flames of hatred, and peace was happily restored.

It was by common consent that he was the first governor of the North Pacific Coast. He endeared himself to the Indian and was always considerate of the red man's feelings and rights. He never forgot that though the skin of the savage happened to have a tinge of copper, this did not pigment the soul. By example, patience, and kindness, he taught, above all, that he was a gentleman in whose heart was knightliness and honor.

However, as one reviews this romantic life of service and sacrifice and gets a more vivid exhibit of the facts, it is apparent that he had his share of sorrow which

is one of the critical tests of life. It was Robertson who said: "Sorrow is not an accident occurring now and then. It is the woof which is woven into the warp of life and he who has not discerned the divine sacredness of sorrow and the profound meaning which is concealed in pain has yet to learn what life is."

The Oregon Donation Land Law took away his land claim and left him in poverty and he died grief stricken of a broken heart. Five years after he was laid in his grave an act of tardy justice was done at last to the memory of this man who went down in sorrow to his grave.

It is but a brief span of years since this intellectual giant of his time who now sleeps where rolls the Oregon left us with a surgical and professional heritage to which we should aspire. And what honors can we do him? We might profit by the example of the great state of Oregon, which restored the name of Mt. McLoughlin to one of its most sublime snow-capped mountains in the southern part of the state. Today we enroll him among America's greatest surgeons.

What Archbishop Ireland said of the church in the northwest might well be said of Dr. McLoughlin. Behold the stately pine solitary in its towering height. Its fellows that once with it beautified the forest have fallen one by one around it that the trees of later germination may measure from it to what growth they themselves should aspire.

The example given us by this pioneer surgeon, statesman and benefactor who was always producing something for the benefit of others handicapped as he was by place and conditions of his time, is an inspiration to the medical student, to the young surgeon and to ourselves. Let us keep close to the trail lest we get lost in this modern age of commercialism and lose the scientific spirit, upon which our work depends.

Oh great hearted fur trader, explorer, surgeon, statesman and Father of Oregon! The immigrants and the Indians who had learned to love and trust their great white faced master as he was known among them—in fact the whole little nation along the Columbia wept when he died and felt that their little world was more lonesome when John McLoughlin went on his last call.

JOHN B. McNERTHNEY

# TRANSACTIONS OF SOCIETIES

## CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETINGS HELD JUNE 15, 1913 DR HENRY F LEWIS, PRESIDING

### HEMOLYTIC STREPTOCOCCI AND THEIR RELATION TO PREGNANCY AND PUERPERIUM

DR A E KANTER (by invitation) read a paper on the relation of hemolytic streptococci to pregnancy and the puerperium (see p. 96)

#### DISCUSSION

DR RUDOLPH W HOLMES It would be a mistake to allow Dr Kanter's paper to pass without discussion. A generation ago puerperal sepsis was considered to be invariably the fault of the physician. This opinion obtained from the dawn of the antiseptic era down to the beginning of this century. Now we know definitely that infection is very largely the consequence of an autogenous bacterial contamination. Since the influenza epidemics, puerperal infections are more prevalent due very largely to the above explanation. To that degree infections are due to the doctor and nurse, contaminated as they may be by some focal infection in themselves, is moot question. Certainly breast infections have been seen more frequently since the epidemics than in all the years of practice before.

I cannot concur with Dr Kanter's statement that instrumentations, vaginal examinations, are no menace to the woman. A physician with conscientious regard to asepsis will have a minimum of infections but the risks are invariably present nevertheless. The man who practices method of routine operative interference will have a higher morbidity than he who practices rational conservatism. I have shown graphically that practically all cesarean sections have postoperative thermal disturbances for the first 4 days, which illustrate the above point.

The method of stopping, seen in so many operating rooms, in the preparation of women for labor allowing water to run down the labial cleft and, perhaps, into the vagina is a fruitful source of contamination.

A great desideratum is to develop technique which will be a ready test for retaining immunity before an operation, or before labor. If this comes we certainly will have developed means of artistically securing such immunity. When this comes we will have puerperium and operations robbed of the dangers of sepsis.

DR GILBERT FITZ PATRICK I wish to support Doctor Holmes in what he has said relative to the care and preparation of patients. Prior to going into

the last war service I had discontinued vaginal preparation for delivery using clippers instead of having the patient shaved. But that is not always possible except where the clitoris is definitely under one's control.

I saw a very interesting case this spring in which elevation of temperature was present 48 hours before delivery. The second day after delivery cultures from the cervix and the uterine cavity were made using the Doederlein method for the purpose of securing pure culture. The pneumococcus organisms were found. Blood cultures were negative. The temperature did not come down to normal at any time until the twenty-third day when shower took place in the right arm. The organisms found were identical with those found in the uterus. There were no vaginal examinations prior to delivery which was spontaneous after 8 hours of labor. Multiple incisions with through and-through dressings resulted in cure. The temperature remained normal after the arm was opened.

DR HOLMES When I was an interne in the Presbyterian Hospital, in 1894 it was the vogue to give woman vaginal douche every hour during the labor, an intra uterine douche immediately post partum and vaginal douches every 4 hours for a week postpartum. With the consent of Dr A C Cotton, I stopped douching as a routine, to the benefit of the women.

DR DAVID S HILLIS If we abolish preparation of the external genitalia before delivery we must cast aside all of the accepted surgical principles. Every confinement case is a surgical case, and potentially a major surgical case. If we were to be assured that every case would deliver spontaneously without perineal injury or vaginal examination, we might safely omit surgical preparation. It has been observed that cases delivered unattended, on the way to the hospital without previous preparation, frequently developed fever in the puerperium. This was probably due to the fact that formerly these patients were shaved and scrubbed after the delivery. Since such cases have been allowed to go through the puerperium without external preparation, the incidents of fever have not been so frequently noted.

DR KANTER (closing) I think Dr Holmes has the right idea that in most of the cases of puerperal sepsis the infection is autogenous provided you do not use antiseptic infection in the strict sense of the word.

In the essay all puerperal infections were held exogenous when the bacteria were brought to the uterus through the blood stream or by extension from a diseased tube or ovary. The difficulty in the bacteriological study of puerperal sepsis is that on the fourth day of the normal puerperium, it is possible to find in the uterus bacteria similar to those found in the vagina during pregnancy.

#### EXPERIENCE WITH ONE THOUSAND CASES OF ABORTION

Dr. DAVID S. HILLIS discussed his experience with one thousand cases of abortion (see p. 83).

#### DISCUSSION

Dr. WILLIAM C. DA FORTH. The statistical studies such as Dr. Hillis has made are very favorable particularly when they concern matters so closely connected with our daily work. This study brings out one important point, which agrees with my own experience, that serious hemorrhage from early abortion is rare. When we consider that fact together with the work of Curtis on bacteriology of the corporal endometrium, it would seem that one should await a definite indication before invading the uterine cavity. Knowing that by so doing bacteria must almost inevitably be carried therein.

Secondly, Dr. Hillis' study brings out the fact that intelligently conservative treatment of abortion yields good results. Observation of our own material has convinced me that his conclusions are correct. I wish that facts brought out by studies of this sort were more generally known and appreciated by physicians. While caring for an infected abortion by the conservative method, the employers of the patient deeming what they thought to be a more rapid mode of treatment to be used, I have recently had the experience of having them consult six general practitioners, all of whom informed them that immediate curettage should be carried out.

Evidently some education along this line is still necessary. Such carefully considered studies as that of Dr. Hillis are of the greatest value.

Dr. RUDOLPH W. HOLMES. Dr. Hillis must be complimented on the colossal work he has done in tabulating 1000 cases of abortion. Unless one has done such tabulation on a small scale, he cannot appreciate the enormous number of hours his work has entailed. I can heartily agree with him that the principal indication for emptying the uterus during the progress of an abortion is hemorrhage. Sepsis alone should not be held to be an indication for artificial evacuation of the uterus.

I am particularly interested in the fact presented that of his 1000 women 24 or 22 per cent. gave the history of a criminal induction. For many years I have felt that criminal interruptions are almost as frequent as those from all other causes of abortion combined. If the truth were known I am sure many more of Dr. Hillis' cases would have been in the class of criminal.

Of Dr. Hillis' cases of criminal abortion 75 per cent. died. This is not high considering the types of patients admitted to the County Hospital. During the years I was chairman of the committee on abortion of the Chicago Medical Society our members agreed that 1 to 2 per cent. was a conservative estimate for the death rate for criminal abortion, this, in view of the fact that most invariably the abortionist does his work in a slovenly if not septic manner. Over and over again during our investigations on the abortion evil we convinced ourselves that the physician who did the popularly called

live saving operation, that is, the curettage, was more responsible for the death than the abortionist himself. This did not minimize the responsibility of the abortionist, for he is responsible for the consequences of his illegal act. When the day comes when we may instill into the minds of the general practitioner that curettage is the last thing to think of in a case of puerperal sepsis instead of the first, then we shall have a great diminution of the death rate in abortion. We would accentuate Dr. Hillis' statement that the presence of fetal contents in the uterus is not an indication for an evacuation of that uterus. Hemorrhage alone should be the guiding indication.

Dr. CHANNING W. BARRETT. I have had 6 years' experience in the same line of work which Dr. Hillis has covered in his statistics and from that 6 years' work I can say that cleaning out the uterus is not so dangerous and not fraught with such serious consequences as Dr. Holmes would lead one to think. I think the abortionist should be held responsible for his acts. I do not think the fact that there are doctors careless enough to rip open the uterus from one end to the other should mitigate against proper treatment being carried out in a given case. If it is good treatment to allow the uterine contents to remain in the uterus indefinitely, why need we have so much trouble with women who have weak hearts or kidney trouble and need therapeutic abortion. All we would have to do would be to run a sound into the uterus and let them pursue the safe course of getting rid of their abortion. As a matter of fact, women with kidney trouble or with lung and heart lesions, who have to have an abortion can be dealt with very safely by emptying the uterus. The trouble is that these cases are usually very much neglected and are treated by the old-fashioned doctor. The patient is prepared surgically for operation, she is put upon the table, the uterus is dilated and emptied, she is put back to bed and we feel safe about what we have done. If that is a safe procedure in a woman who is below par it seems to me we should deal with her abortion by emptying the uterus. This should be done in such a way that it does the least possible damage to the organ, and in as safe a manner as possible. The very nature of the growth of the ovum in the uterus makes it not ready for good separation at 1 month, at 3 months or even 4 months. If separation does occur during this time there is a great tendency for some of the mater-



ual to be left in, and when this material is left in it becomes septic. When it becomes septic, the best possible way to have the uterus do well afterward is to empty its cavity without doing a lot of damage to the organ. The foreign material can be gotten out with thorough curettage without ripping the uterus from one end to the other.

The statistics of Dr. Hillis indicate that there is quite a number of cases that do not go wrong even when material is left in the uterus. It is also stated that some of them do go wrong. Most of those patients could have been started on their recovery by going in at the end of 5 days if the curettage were done carefully. I say that with due regard for the splendid showing in this series of cases.

Dr. EDUARD REESE: A great many years ago I quit the practice of obstetrics, but while working at the Michael Reese Hospital in a department in which all cases of abortion were assigned, I took special interest in the treatment of abortions in their natural and unnatural course.

I, my experience as interne I had passed through period of conservative treatment with very poor results and had turned to every conservative way before

894 I had had no cause to change my attitude and am teaching the conservative method today.

This treatment was carried out in my service at Michael Reese Hospital and at Post graduate Hospital and I have read report on it before this Society and published it in *SURGERY GYNECOLOGY AND OBSTETRICS*. You may find the result there.

Now it would not be right to enter into such discussion as I have had tonight without mentioning Winter who started this discussion anew all over the gynecological world. Also it would not be right to discuss this subject without considering that the gynecological literature of the world presents today, though there never as much middle as long as I can remember. We have the same kind of statistics in every issue of the *Centraleblatt* and the *Archives* in the French periodicals, the English and American periodicals. We have the same kind of statistics in all of them. And one man concludes that conservative treatment is the best. Another man says and supports it by statistical evidence that curetting is the best treatment for abortion, and in the last few papers I have been studying the authors have come to the sensible conclusion that the question cannot be solved by statistics at all.

Tonight Dr. Hillis concludes from his statistics that conservative treatment is the best and he takes exactly the position I do. And then I hear Dr. Barrett say that according to his results active treatment is correct. There must be something wrong with the statistics, and I wish some one could tell me that.

Dr. GILBERT FITZ PATRICK: What has been said simply proves the trend of medicine and teaching of medicine during the last 25 to 30 years. We are treating the disease instead of treating the patient.

We are still trying to develop a treatment which will fit every patient, that has always proved to be totally impossible. The probabilities are in the final analysis that the end results are dependent upon the personal equation of the patient, provided the treatment and management is founded upon a thorough knowledge of the case in hand.

Dr. HILLIS (closing): I have three cases in mind from the service of the County Hospital which were being treated conservatively. The temperature curve was gradually going down and a general improvement was in progress when urged by every anxious friend they were taken out of the hospital, curetted the next day by some outside doctor and all died within 3 days.

Dr. REESE: And you got the blame?

Dr. HILLIS: Yes. That element of danger mentioned by Dr. Holmes, namely, unintentional injuries to the uterus during curettage, is of less importance, in my opinion, than the effect of a curettage which is full done. The criminal abortionist introduces the infection into the uterus and the doctor who curettes afterward, although he may be extremely skillful in the use of the curette, spreads the infection further into the deeper tissues, and probably the more skillful he is the more harm he will do. He tries to remove all the infected material and the bacteria with the curette which is impossible. In my opinion, he may do as much harm as the man who tears the uterus from the fundus to the cervix.

Although it is true that nothing can be proved by statistics it would seem probable that comparison of the results under extreme conservatism and with treatment carrying out active local measures would give some indication of relative value of these two methods, provided, of course the cases are in large series and honestly reported.

I agree with Dr. Fitz Patrick that it is desirable to treat the disease instead of the patient. It is obviously and certainly impossible and undesirable to treat all cases by rule, but in the present state of the abortion question, upon which there is so much difference of opinion, it is desirable to determine if possible by experience which plan of treatment yields the best results, and which plan will do the least harm. I think our position with regard to this condition is something like this. We know that we can curette some cases and the patients will promptly get well. We know that if we curette others they will promptly die, but we do not know which ones we may safely curette and which will be harmed by curettage.

Since we cannot determine beforehand clinically or by means of the laboratory what to do with these cases, experience with a given method of treatment is all we have left to solve the problem. Figures in this paper are as accurate as they can be made. They seem to point in one direction that is, good results can be obtained by a rather extreme conservative method of treatment.



# The noble experyence of the vertuous

handywarke of surgery practysed & completyed by the most experie may-  
ster Thomas of Campdenke/ doctour in the facultye in this arte/ & whiche hath litle  
yet/ and whiche is made by his owne hand practysed. ¶ Item there after he hath taught  
and bene it to be deduced through the true sentences of the olde doctours and maysters very  
experie in the facultye of surgery. As Galenus/ Apocras/ Avicenna/ Serapion/ Rhazes/ Abo-  
Lancranus of Naples/ Ramonius/ Rogerius/ Albucasis/ Avenzoar/ Sydenham/ and others  
was de facto/ & by many other maysters whose names be written in this booke. ¶ There  
also shall ye fynde for to cure here all moost difficultes/ and other woollinges. ¶ Item ye  
fynde out names of herbes & of other thynges wherof ye have no knowlege/ & shall ye knowe  
playnly by the power of the. ¶ Item there shall you fynde also how to make salutes/ plasters/ pow-  
ders/ oyles/ and suppers for moost. ¶ Item how to dyvers of thes sciens/ & playn know-  
lege let them often times rede this booke/ and then ye shall gette perche to be a handywarke of the  
noble surgery.



# THE SURGEON'S LIBRARY

## OLD MASTERPIECES IN SURGERY

B ALFRED J BROWN M D I A C S OMAHA, NEBRASKA

### THE SURGERY OF HITRONYMUS BRUNSWICK

THE noble experience of the ertuous handy  
warke of surgeri, practysed & compyled by  
the moost experite mayster Iherome f Brunswyke  
borne in Strasborowe in Almayne y<sup>e</sup> whiche  
bath it fyrst proved, and trewly founde by his  
owne dayly exercysynge Item thereafter he hath  
authorised and done it t<sup>e</sup> understande through the  
trewe sentences of the old doctours and maysters  
very experts in the science of Surgery As Galenus  
Ipoena, Avicenna, Gwydo, Haly abbas, Lanefrancus  
of nylen, Lamerous, Rogerius, Albrucanus, Place(n)  
tusa, Brunus, Gwilbelmus de saliceto & by many  
other maysters whose names be y<sup>e</sup> rytten in this same  
boke Here also shall ye fynde fo<sup>r</sup> to cure and hele  
all wounded me(n)beres, and others w<sup>h</sup> llynges Item  
y<sup>e</sup> ye fynde only names of herbes or of other  
drynges whereof ye have no knowledge yt shall ye  
knowe playnly by the potecarys Item here shall  
ye fynde also fo<sup>r</sup> to make salves, plasters, powders,  
oyles, and drynges fo<sup>r</sup> woundes Item whoso de  
syrth of this science ye playne knowledge let hym  
ostentymes rede this boke, and than he shall gette  
perfyte understandynge of the noble surgery

Jerome, of Brunswick, was an Alsatian army sur-  
geon who was born about 1450 and died 1533. The  
English edition of his work bearing the above title  
revived from the excellent collection of Dr LeRoy  
Crummer, of Omaha, was printed at London in  
Southwerk by Peter Treverth, March 16 1535, and  
has the distinction of being the first illustrated work  
on surgery printed in the English language. The  
German, or first, edition was entitled "Das ist das  
Buch der Chirurgia (Hantwundung der Wundartz-  
ney) 1407 Strasburg, von Hieronymo Brun-  
schwicker."

In his prologue Jerome warns against the barber  
surgeons and offers advice to students and young  
surgeons which is as of as much value today as then.

The work itself may be divided into three parts.  
The first, as is usual in the majority of old surgical  
works is a review of the then known anatomy of the  
body and the necessity of a comprehensive knowl-  
edge of anatomy is stressed in the prologue. The  
second part includes the surgery proper. Being the  
work of an army surgeon it deals with wounds,  
fractures, and dislocations only. His account of gun-

shot wounds is the first detailed account in medical  
literature. Preceding each of the three divisions,  
wounds, fractures and dislocations is a description  
of the treatment of the condition in general. Then  
follows the classification of the various types of each  
and a description of the treatment applicable to each  
type. The nature of wounds is carefully described  
and several forms of its nature noted. Hemorrhage is  
also spoken of and, though the ligation of vessels is  
usually attributed to Pare Jerome describes it ac-  
curately and states, that, when feasible it is the  
best way of combating hemorrhage reserving ther  
methods such as pressure, styptica, and cautery for  
oozing wounds. As this book was published in the  
German edition before Pare was born it is probable  
that Jerome through his study of former authors,  
rediscovered the method and Pare later applied it to  
the treatment of vessels in the amputation stump  
and popularized it. He says: "The fourth manner is  
that sometime a stycheunge or festynynge happeneth  
(or t<sup>e</sup> staunt) be blode and that is when ye se a  
vayne bide so<sup>r</sup> as the vayne of th<sup>e</sup> neck or ye  
wou(n)ded betynge vayne thrust that vayne  
through w<sup>h</sup> the nedvill and after the nedvill knet  
the ayne fast with ve threde that is in the nedvill &  
then draw the nedvill through and let an ende of the  
threde byde ha(n)gynge at it a certain dayes tyll  
that upper part of the vayne doth putrify and that  
ye threde go out by hymself. He warns against leav-  
ing dead spaces in sutured wounds and ad-  
vises against allowing wounds to heal before suppuration  
and pain have disappeared. In the same general way  
fractures and dislocations are taken up and classified.  
Many interesting pieces of apparatus for the reduc-  
tion of deformity and immobilization of fractures are  
illustrated. A study of these shows plainly that the  
general principles of reduction and immobilization  
of fractures were well under tood by the author. The  
third division of the work, the ant doctharium de-  
scribes in detail the method of making plasters, oint-  
ments, et<sup>c</sup> recommended for use in the text.

Jerome, of Brunswick, was evidently one of the  
foremost surgeons of his time. He refers in his work  
to the masters if previous periods and was evidently  
a student. Reading of his work shows him to have  
been a most careful observer and a clear thinker  
who was able to draw deductions from his observa-  
tions which were far in advance of his time.

History of Medicine Garrison p. 86  
Reading room 10777

History of Medicine, from translated by Phaedrus, p. 307

## REVIEWS OF NEW BOOKS IN SURGERY

THE a erge medical man's knowledge of diseases of the colon and rectum is exceedingly limited. For the past few years there has been quite a stimulus offered by various men for more thorough study of those diseases which involved the colon, and at the present time it is pleasing to note that the various types of colitis are receiving their more or less deserved attention.

There is no doubt that many individuals have been operated on and their appendices removed, when their real trouble lay in the colon, and the patient received only the devastating effects of the operation and continued to carry his malady with him. The practice of proctology for many years was in the hands of charlatans. These men, by some unique maneuver about the anus, pretended to cure everything from epilepsy to gastric ulcer. A few men had the courage to take up the subject of proctology and the diseases of the colon, and after prolonged and conscientious study have compiled information which is invaluable to the medical profession. They have taken this subject from the hands of the charlatans and have placed it upon sound scientific basis. Probably no other one man is more deserving of credit and praise than Gent. In recent three volume edition the author attempts to place before the reader a classic study of the diseases of the appendix, colon, rectum, and perianal region.<sup>1</sup> This is not a revision of any previous work, but is a new work with new illustrations, photographs, X-ray reproductions, etc.

There is given more or less detailed description of the anatomy of the parts, which is of value not only in making diagnosis but in operative treatment. The author describes with considerable detail his method of local anesthesia in work about the anus and draws its use in selected cases. It would seem that this alone—namely that in any conditions about the anus, chief of which are hemorrhoids, can be operated on without general anesthesia and with very little postoperative discomfort and disability—is a great stride in the right direction.

He gives very lengthy description of those diseases of the rectum, anus, and perianal region which may be encountered. It is rather disappointing, however, that in many instances the symptomatology is quite confusing. A little more brevity and little better choice of words would be quite gratifying. The subject of carcinoma of the rectum is taken up in detail, and here again the author has missed his point. If carcinoma is to be cured, the diagnosis must be made early and it is the reviewer's impression that the author lays entirely too much stress on cachexia in the differential diagnosis between benign and malignant growths of the rectum. Cachexia is generally a late symptom

in any carcinoma and above all else, in rectal carcinoma. It can be readily seen why so per cent of all cases of carcinoma of the rectum come to the surgeon inoperable. We depend upon such men as Gent and others to present to the medical profession those findings which will enable them to make a diagnosis of cancer in such an amenable part early enough to be removed with a certain surety of success without recurrence. The reviewer would like to have seen in this treatise some definite statements made in regard to early diagnosis of carcinoma of the rectum. We must look to the men who are students, thoroughly trained scientists, and who have an extensive clinical experience, to give to the profession absolutely authoritative technique. These men must have the courage of their convictions and in spite of the fact that their stand may appear radical, yet in no other way can so big a thing be accomplished.

The subject of colitis is covered in a very thorough manner but here again many instances the author is not explicit either in symptomatology or in the line of treatment that he himself advocates in the individual cases. He may know what line of treatment he would institute in the individual case, but in many instances his text is quite confusing, and it is left to the discretion of the reader to choose his form of treatment. In many instances that would not give the desired results.

This work contains an enormous amount of information, so arranged, however, that it lacks clarity much of the value thereby being lost. In addition, though certain portions are admirably written, sufficient stress is not laid upon essentials.

AT no time is one's surgical ability put more to a test than when he is confronted with some emergency condition in which the diagnosis is doubtful and in which the course of surgical procedure is in question. One need only to lay in mind acute injuries to the head, injuries to the lungs, and certain acute abdominal conditions, to realize to what extent life may depend upon the judgment of single individual. It is true that probably in many conditions surgical operation is necessary and that an exact diagnosis is not essential. This applies especially in acute abdominal conditions. Yet at this very phase of surgery there is a certain number of acute abdominal catastrophes in which it is better judgment to postpone operation than to invade at once.

It is, therefore, of more than casual interest to receive a new edition of the work of Lejars. This is an English translation of the eighth French edition, and the author has but very little deviated from his former attitude. He has incorporated in this new

DISCUSSION OF THE RECTUM, ANUS, AND COLON. By Samuel Gent, M.D. LL. D., with 25 plates and 10 photographs and London. W. B. Saunders Company, 1921.

URGENT SURGERY. By Felix Lejars, of English and translated from the French of Dr. Felix Lejars, M.D., and Dr. J. L. B. F. R. C. S. and Dr. J. L. B. F. R. C. S. New York: W. B. Saunders and Co., 1921.

work those principles and lessons taught us by the war particularly those in regard to visceral injuries and extensive wounds of the soft parts. Those who are not familiar with the work of Lejars will do well to heed the teachings of this master surgeon. The text is arranged in a very satisfying manner. The author discusses wounds and acute processes of the various regions, beginning with the head, and continuing through the neck, thorax, spine, abdomen, etc. Many conditions are exemplified by case records in which there is noted the history of the patient, the method and reason for making a diagnosis, and the reasons for or against immediate operation and the findings.

The author apparently has great faith in the infusion of saline solution, and this American surgeons will probably under certain conditions take exception. Not that the American surgeons do not realize the great benefit and in many instances the absolute necessity of saline infusions, but in those cases in which there is a hemorrhage in process and before it has been checked, the average American surgeon will refrain from using intravenous salt solutions. Probably in only one other instance does the author's method differ from those accepted in America—namely in treatment of infections of the hand. Here it would seem to the student of surgery of the extremities that he does not conform entirely to anatomical and physiological principles.

With all, this is probably one of the most instructive volumes of its kind in print today. The author shows evidence of a very ripe experience and very mature judgment. His methods of making diagnoses and his utter fearlessness in many instances, give him results which are more than could be hoped for. His manner of expressing his thoughts and his mental calculations in making diagnoses, are exceptional. No surgeon who is called upon to treat emergency cases, especially of the major type, should fail to study this work.

THERE seems no question but what more and more surgical operations are being performed without general anesthesia. Two sides may be taken on this question. There is no doubt in the reviewer's mind that many surgical procedures should be carried out under local anesthesia, furthermore that there are many surgical procedures that can be carried out under local anesthesia, in which the individual indications must be judged by the operator at the time the operation is to be performed. The question arises whether the mental anguish and exhaustion subsequent to an operation performed under local anesthesia is not as devastating in certain neurotic individuals as general anesthesia. There is no question but what the average surgeon minimizes the psychic factor in his patient and that he boldly performs an operation not necessarily causing a great deal of physical pain but enormous mental distress, and that this may be as destroying to the individual as certain postanaesthetic pathological conditions.

Farr<sup>1</sup> in his recent work, attempts to correlate these two factors in his so-called psycho-local anesthesia. In this work the author gives the reader his own impressions on the subject of local anesthesia as he has observed it in his own practice and operations, and since his experience has been enormous it is well worth while for the average surgeon to read his teaching. The text is divided into three parts. The first six chapters are devoted to certain problems to be considered in connection with anesthetic equipment, and a description of the sensory nervous system. The second part, consisting of five chapters, considers regionally all portions of the body except the abdomen, and in the third part, surgery of the abdomen is covered.

In the author's discussion of regional surgery the technique of local anesthesia is correlated with that given in previous chapters in which the subject is discussed in a rather general way. Many illustrations are used to guide the reader in forming a more accurate conception of what the author has in mind. In many instances the topic is illustrated by case records and actual photographs.

Many operating surgeons will be astounded to note the scope covered by the author in his operative work under local anesthesia, as from his text one is allowed to believe that any surgical procedure can be carried out successfully under local anesthesia without pain or discomfort to the patient. If such is the case, then by all means the subject should be more thoroughly studied by the average surgeon. We must all realize that a general anesthetic carries with it not only the danger of an immediate mortality but the possibility of those postoperative hazards, such as lung infections, heart complications, and renal and liver insufficiencies. Therefore if local anesthesia offers us a method whereby a surgical procedure can be carried out without pain and without too great a degree of psychic shock and with minimum danger of postoperative complications, the surgical profession should be obligated to put this procedure more generally into use.

TO those who are interested in contributions from the Mayo Clinic, the collected papers for 1932, just received, will be welcome. As usual, the papers included in this volume deal with diseases of practically every region of the body. It is very pleasing to note the consciousness of the majority of the articles, most of them being brief, very clear and to the point.

There are eighty-seven contributors to 142 articles in this volume. One cannot help but be amazed at the tremendous amount of work done in this institution covering the ordinary routine clinical work, which is carefully studied, as well as research and experimental work.

PRACTICAL LOCAL ANESTHESIA, by DR. STUART TAYLOR, B. Robert Emmett Farr, M.D. F.A.C.S. Philadelphia and New York: Lea & Febiger, 1933.  
COLLECTED PAPERS OF THE MAYO CLINIC, Edited by Mrs. M. H. Campbell. Vol. 27. 1422. Philadelphia and London: W. B. Saunders Company 1933.

Practically all of these papers have appeared in some journal, and probably the average surgeon has either heard or read certain number of them. To those men who respect careful study and who wish to have at hand a collection of most interesting papers which are based on sound scientific facts, this volume offers an opportunity. The majority of the papers deal with practical conditions. There are also articles which will appeal to those more inclined toward progressive medicine—namely the articles by Mann and Magath—studies of the physiology of the liver and the effect of total removal of the liver after pancreatectomy; also the work of Rosenow—the production of urinary calculi by the desiccation and infection of teeth in dogs with streptococci from cases of nephrolithiasis.

A review of this book is impossible. It need only be said that the volume contains papers of unusual interest and of unusual value, and for those men who are inaccessible to medical societies and to the current journals the book offers a collection of papers of thorough scientific value.

THE little volume by Finsterer will be of decided interest to the abdominal surgeon. The author tells, in no mistaken terms, his reasons for the use of local anesthesia. He condemns general anesthesia on account of the frequency of lung, heart and liver complications, and with the technique which he has evolved he is enabled to perform practically any intra-abdominal operation under local anesthesia, without pain to his patient.

His technique begins with the operation to be

performed and the more or less exact conditions found upon the operating table. He describes in great detail the infiltration of the abdominal wall and splanchnic anesthesia as advocated by Braun and Kappas. Under certain conditions he has varied the technique to meet the individual demands. The technique is divided into three groups which he has designated as for small, middle size (medium) and large or extensive operations.

In the first group he includes operations such as gastrotomy, enterostomy, etc. In the second group, hernia of various types, appendicitis, exploratory laparotomy. In the third group he incorporates sixteen operations, which include the stomach, the duodenum, liver, gall passages, the intestines, rectum, the spleen, the kidneys and female adnexa.

In each of these groups he describes the technique of administering the anesthetic for the individual case. In the discussion on gastric resections he describes the various operations which he himself employs, the reasons for using them and the results. His operations are decidedly radical and very extensive, but apparently his results are unusually good. His experience in abdominal surgery with local anesthesia has been enormous and in spite of the fact that many of his principles will not be accepted by the average surgeon, either due to the fact that his physiological principles are wrong or that his technique is too radical, nevertheless much is to be gained by reading what this dexterous operator has to say. His text is very clear and he is most emphatic in stating his opinions. For those who can read German and who are interested in abdominal surgery and especially abdominal surgery under local anesthesia, the reviewer very heartily recommends this little volume.

J. A. WOLFE

DR. METZGER'S LOCAL ANESTHESIA IN HER HAND-PRINTED BOOK, "LOCAL ANESTHESIA IN HER HAND-PRINTED BOOK," Berlin and Vienna (Friedr. & Schönbach, 1913).

# AMERICAN COLLEGE OF SURGEONS

## A SUMMARY REVIEW OF THE HOSPITAL CONFERENCE OF THE CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

By MALCOLM T. MACFACHERN, M.D., C.M., CHICAGO  
Associate Director, American College of Surgeons—Hospital Activities

THE 1923 sessions of Hospital Conference of the Clinical Congress of the American College of Surgeons extended over two days instead of one, as in former years. The success attendant on this innovation justifies its continuance. Surgeons from all parts of the United States, Canada, South America, Mexico, Cuba, England and Ireland, almost 3,000 in number in addition to hospital executives, trustees, nurses, and others attended the sessions at the Congress Hotel October 22-23, 1923. The program covered four sessions, including two very interesting round table conferences, a symposium on hospital standardization, and a staff conference demonstration. Each session was attended beyond the limit of capacity of the hall, and it was plainly obvious throughout that the interest did not wane for a moment at any time.

The program was designed to deal with the details of hospital standardization, and precipitate discussion on difficulties and problems encountered. Every subject or topic had some bearing or other on the practical application of one or more of the principles involved in hospital standardization. The entire meeting took the form of a great "clearing house" so to speak, for the ever-growing movement of hospital standardization. The interest shown in and out of session was intense. The Hospital Standardization and Information Department was busy from 7:30 a.m. to 1 p.m. daily. It is estimated that over 2,400 interviews were held during the 5 days of the Congress. A splendid opportunity was thus afforded all present to see the work accomplished, so comprehensively shown in the exhibit to consult with those in authority as regard to the difficulties encountered in promoting hospital standardization and to secure literature pertaining to the movement, which was given upon request. Through this department and the contact which it afforded, the officials of the College charged with the responsibility of hospital standardization, had a good opportunity to

get much better acquainted with the hospital executives and surgeons, and it was very gratifying to the executives to find so much general interest in the movement.

Because of the lack of space it is impossible to give the full proceedings of the conference, a complete report of which will be issued shortly. This article will attempt only to summarize the proceedings in a more or less inadequate manner.

The opening session on the morning of October 22 was presided over by the president, Dr. Harvey A. Cushing of Boston. Dr. Franklin H. Martin, the director general, the first speaker officially announced the list of approved hospitals up to October 22, 1923, which included all active general hospitals of fifty beds and more in the United States and Canada surveyed during the year and meeting the minimum requirements of the American College of Surgeons. A copy of this report was placed in the hands of each person upon leaving the hall later. It was gratifying to note that 1,176 hospitals (65.9 per cent) out of the 1,786 surveyed, met the minimum standard laid down by the College. He called attention to the fact that the sixth milestone of this great movement had been successfully passed and the seventh reached. It was a movement designed primarily to standardize surgery and the surgeon, but, because of its purpose, its all embracing, practical, and sensible requirements and its recognized worth the movement had spread inevitably to every phase of the medical profession in making hospitals more efficient and more scientific places in which to work and treat patients. A need was discovered by the College a remedy was found to meet that need the remedy was applied in a practical manner through this movement, which is ever increasing in momentum and permanency. The hospitals have willingly and in a solicitous manner taken to the program because its requirements are reasonable, its methods of presentation acceptable, and the work of the hospital investigators,



because of the personal visits and the impartial manner of making reports, appeals to the hospitals as an honest, unprejudiced, disinterested effort to arrive at facts. Without ostentation this movement for hospital betterment has been its only propagandist. It has convinced the medical profession that a great event has been transpiring that when two or more individuals get together in harmony even in the profession of medicine, and pursue a course of self-betterment the results are stupendous, the effect inspiring. Every hospital trustee, every superintendent, and every nurse of the North American continent have been drawn into the vortex of this movement and each one prides himself on his part in it. The public has been consulted by the hitherto exclusive profession of medicine and has been asked to share the responsibility of aiding the betterment of hospitals. Business men of large and small communities have learned that the profession of medicine can conduct its affairs in a business-like manner as well as wield the scalpel and administer drugs. One of the conservative philanthropic foundations, the Carnegie Corporation, after a thorough investigation of this program, for five years contributed toward its financial support to a sum aggregating \$105,000. In addition to this a sum of \$220, 83 09, contributed by the College represents a total expenditure during the five years of \$325, 83 09.

The value of hospital standardization to the small community hospital was most forcibly presented to the audience. Through this movement the hospital benefited in many ways, but particularly in the added stimulus for more scientific work and especially in promoting better co-operation and fellowship among the group of doctors attending.

A strong plea was made for follow-up work in hospitals. Without this we have no definite way of knowing what the results of treatment really are. This is the day when we want facts—facts that will guide us in future procedures and activities. These can come only from the study of end results, a phase of work much neglected in most hospitals today. The value of a simple surgical rating system was demonstrated and submitted as a practical and necessary procedure in hospitals. A rating system of this kind may be defined as a condensed expression of results applied and lending itself to comparison and summation. Through such a method as illustrated, we are able better to appraise surgical work in hospitals.

The problem of the interns is of great interest to all hospitals at the present time. A great deal

of thought is being given to this question by competent committees, but no general recommendations have been put forth as yet. The present status of the interns question is possibly best indicated in the following extract, taken from the essayist's paper at the conference:

In 1918 the American College of Surgeons started their campaign for standardization of hospitals which, although not directly dealing with the interns question, has indirectly considerable effect.

"In 1919 a tentative schedule of essentials in a hospital approved for internes was prepared and published by the Council on Medical Education and Hospitals of the American Medical Association, which has formed the measure by which hospitals could be judged as to whether or not they provided suitable training and teaching for internes, in return for their services in carrying on the work of caring for patients in the hospital. In the best hospitals most of these requirements had already been in force having been introduced by their staffs and managements in order to attract the best internes and in order to carry out the teaching function which was beginning to be accepted as an important part of a hospital's service to the community.

This standard, similar in most respects to the minimum standard for hospitals prepared by the College of Surgeons, imposes no hardships upon the larger general hospitals, enumerating mainly what had already been found to be for the best advantage of the hospital its patients, and internes. As applied to the smaller hospitals of from 25 to 100 beds the literal fulfillment of these requirements was often burdensome and difficult, but these difficulties were in most cases bravely approached by the hospitals and arrangements made which provided for the carrying out of the spirit of this standard.

"The essentials are: (1) There shall be an organized staff willing to assume the obligation of teaching internes by personal instruction and by monthly clinical conferences. (2) The hospital must have a pathological department, suitable laboratories, X-ray equipment and roentgenologist, library, and proper quarters for the internes. (3) Real records of cases must be systematically taken and properly filed under the care of a librarian. (4) The work of the internes must be regulated so that they will systematically take up history-taking, clinical laboratory work, X-ray anesthesia, maternity cases, necropsies, responsibility for the diagnosis and care of patients, surgical dressings, operations, etc. Without specifically so stating, it is suggested that,

where a non-rotating service is chosen, additional service be taken in a hospital that will supply any deficiency in training."

A review of nursing in the United States and Canada by two great leaders in the profession, showed comprehensively that great progress was being made to meet the demands of modern day civilization and development. Hereto the field is rapidly expanding, and many problems of mutual interest to the nursing, the hospital and the medical professions were discussed.

A more particular consideration of hospital standardization in its different phases was presented in a well arranged program which may be taken up under the usual headings.

#### STAFF ORGANIZATION

From the addresses, papers, and discussions, it could be gathered that this phase of work is being more easily and satisfactorily carried on though difficulties are still encountered, particularly in the securing of the right kind of staff conference and in the elimination of fee-splitting. In regard to the former the staff conference the solution lies in the following: (1) a full measure of co-operation among the doctors attending the hospital (2) active leadership especially in chairman and secretary of staff (3) an inherent habit or desire on the part of each member to present his experiences, not only for his own benefit but also for that of others (4) the providing of an interesting agenda, supported by the pathologist and his findings, as well as the radiologist and other heads of medical departments in the hospital (5) a frank, kindly and constructive discussion of the work of the hospital. Fundamentally there must be the belief that such meetings are right and worth while. There must be developed the honest, sincere, studios, searching spirit which, in the words of Father C. B. Moulmier president of the Catholic Hospital Association, and an ardent worker for hospital standardization, will find the facts,

filter the facts, fix the facts, focus the facts on the patient, and "face the facts fearlessly."

Analysis of one hundred hospitals of one hundred beds and over failing to meet the standard this year showed that 57 per cent lacked the proper staff organization 96 per cent had only a partial analysis of the work or none at all and 64 per cent had not taken action against fee-splitting.

A staff conference demonstration by the Evanston Hospital staff presented in a very comprehensive manner the practical carrying out of a

good conference and was of intense interest and profit to all present.

#### CASE RECORDS

This subject received major attention during the conference and was very completely covered by a number of speakers with extensive experience and expert knowledge. The essentials for good case records, as gathered from the opinions expressed, may be summarized as follows: (1) a serious realization by all connected with the hospital that records are essential for its proper conduct (2) all-round co-operation of the board of trustees, medical profession and hospital staff (3) a record department well equipped and having good personnel that shows leadership initiative and originality, (4) the securing of the record early with all its logical, component parts. This may be accomplished in various ways: (a) the doctor writing it himself (b) the doctor dictating it to the record clerk or through the dictaphone (c) the intern writing it under the supervision of the doctor in attendance on the case. The best record is the one conscientiously produced by the doctor himself who should supervise the production of the same, no matter how obtained. The record clerk is an invaluable adjunct in the securing of records and all hospitals should have such an official. (5) The proper filing of records. The filing of records is important from the standpoint not only of ready reference but for scientific purposes. All hospitals should have well organized filing systems. At first these may be simple but gradually they build up into a well amplified system.

Interest and leadership as demonstrated by the speakers on this occasion are necessary for good records in any hospital. Example should be taken from two of the leading surgeons who addressed the conference on this subject.

One of the essayists on the program, dwelling at length and in a masterly way on the difficulties in securing records, enumerated the following eight in number: (1) "Lack of knowledge of board of trustees as to the real value of records and consequent lack of proper financial support for a record department. This can be overcome by an educational campaign on the part of the superintendent and the staff who should lose no opportunity to convince the board. (2) A dearth of educationally trained record librarians. This can be lessened by standardization of the qualifications and requirements for the position. (3) Lack of co-operation on the part of the staff. This can be largely solved by the creation of a committee on records. (4) Non-conformity of

nomenclatures. Here the remedy is a paraphrase of Chief Justice Chase's terse statement: the way to conformity is to conform. (5) Worthlessness of most statistics. Meaning can be put into these only by completion of records from day to day. (6) Poor quality of records. Emphasis on this at staff meetings is the only means of producing results. (7) Slight use made of records. This can be encouraged by the compilation of data in good form for scientific purposes, the medical society meetings, the working up of practical subjects by doctors for presentation in paper or essay form, the compiling of data for annual reports, and in many other ways. (8) Tendency to throw all responsibility of records on the hospital. Pressure on the hospital has just reached the point of maximum tenacity. Further advance will have to be made through interest in the cause on the part of the medical profession at large.

#### DIAGNOSTIC AND THERAPEUTIC FACILITIES IN HOSPITALS

It is clearly evident that hospitals have greatly increased their interest and their activities in diagnostic and therapeutic department. These departments with their various branches of services are extremely essential in assisting the doctor to make or to confirm his diagnoses.

*Clinical laboratory.* The main speaker on this subject summarized his remarks as follows: The personnel of the hospital laboratory should consist of a clinical pathologist in charge, a young physician in training for clinical pathology and as many technicians as the work of the institution may require. It should be located adjacent to the operating room, preferably on the top floor with a northern exposure, and subdivided into five rooms, including a private office for the clinical pathologist. The equipment should be adequate for the carrying on of all of the necessary tests in clinical microscopy, pathological histology, bacteriology, serology and chemistry. As a matter of routine, the laboratory department should determine the condition of the blood and urine of all patients entering the hospital, and write into the records of the institution the results of histological examination of all tissues removed at operation. A Wassermann test should also be done as a matter of routine, at least upon chronic cases. The clinical pathologist should be freely employed as a consultant by the staff and it should be considered his privilege and duty to perform any tests which, in his judgment, might throw light on the condition of any patient. The activities of the hospital

laboratory should be confined to the institution alone, unless it happens to be the only available center of clinical pathology in the community.

The essayist did not venture a satisfactory method of financing laboratories, stating that this problem was a matter for future solution. During the meeting, however, the question of financing laboratory service came up on several occasions. There are apparently many methods in vogue for making charges today. The following were mentioned: (1) a schedule of prices at so much per test or examination; (2) a flat rate fee covering all the laboratory work required; (3) the addition of a certain amount to the per diem charge made to the patient, so as to cover all laboratory service; (4) a free service, as might be found in a hospital having an endowed laboratory or supported entirely by the state. Opinion appears divided as to the most generally desired method of making charges. A compromising suggestion, worthy of note, was that there should be a flat charge for such routine tests as urinalyses, blood count, smears, and possibly Wassermann tests; the rest to be charged for according to a schedule adopted by the hospital. The charges made should not embarrass the service by limiting the use of the laboratory.

*X-ray department.* This is a very important diagnostic and therapeutic department nowadays in hospitals. It is, indeed, a rare thing to find a hospital without an X-ray service. The rapid development, however, needs more words of caution and warning lest the quality of service deteriorates. The principles of development and management are much the same as in the case of the clinical laboratory. The main speaker on this subject brought out all the facts concerning the efficient operation of this service in any hospital. Some of the more outstanding features which were referred to may be summarized as follows: The personnel of the X-ray department should consist of a radiologist who should be in charge. This should be a medical man, preferably one of clinical ability and experience. It is always advisable, if possible to have a young physician in training as an understudy. There should be as many technicians as the work of the institution may require. The X-ray should be located adjacent to the operating room, so as to promote good team-work between the surgeon and the radiologist. There should be sufficient floor space to provide for at least a waiting room and office, and view operating, fluoroscopic, filing, and developing rooms. The equipment must be adequate for carrying on radiographic and fluoroscopic work, as well as doing superficial and deep

therapy where deemed advisable. All interpretations must be done by a competent medical radiologist. A record of the work should be kept in the department and a duplicate copy sent up to the ward to be attached to the patient's file. Radiologists should be freely employed as consultants to the staff and should attend the staff meetings. It should be his privilege and duty to make any X-ray examination which, in his judgment, might throw light on the condition of the patient. The activities of the department,

like the clinical laboratory, should be confined to the institution alone, unless it happens to be the only available X-ray in that community.

In addition to all that has been referred to in this very inadequate presentation or review there was valuable discussion of twenty two important topics in the round table conference, which threw particular light on numerous problems troubling the hospital representatives who came to the meeting, a full report of which will appear in a bulletin early in the year.

## INDIANA AND ONTARIO AND QUEBEC SECTIONAL MEETINGS OF THE CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

### INDIANA

THE sectional meeting of the American College of Surgeons for the state of Indiana was held in Fort Wayne on November 14-15. Headquarters and registration rooms were at the Anthony Hotel. Clinics were conducted on both days at St. Joseph's Hospital.

The hospital conference was held in the ballroom of the Anthony Hotel at 2:00 p.m. on November 14. Dr. A. E. Buhon, chairman of the Indiana state committee, presided. Following this meeting an illustrated address on the Activities and Organization of the American College of Surgeons was given by one of the associate directors.

The following state committee was elected for next year:

Chairman—Dr. Edmund D. Clark, Indianapolis  
Secretary—Dr. E. E. Pudgett, Indianapolis  
Counselor—Dr. Stanley A. Clark, South Bend

The community health meeting was held in the Majestic Theatre and long before the time for the opening of the meeting the theatre was packed and there was standing room only. The audience was extremely interested and enthusiastic. The attendance was approximately eighteen hundred.

The scientific meeting was held in the ballroom of the Anthony Hotel at 2:00 o'clock on the afternoon of the second day. At this meeting illustrated addresses were given by Dr. Nelson M. Percy of the Ochsner Clinic, Chicago on "Blood Transfusion" and Dr. James T. Case of the Battle Creek Sanitarium, Battle Creek on "Intestinal Disturbances."

The preliminary arrangements for these meetings in Fort Wayne were exceedingly well carried out. The local Fellows of the College are to be congratulated.

The visiting speakers were: Dr. A. J. Ochsner, Chicago, president of the American College of Surgeons; Dr. Franklin H. Martin, Chicago, director general of the American College of Surgeons; Dr. George Crile, Cleveland; Dr. James T. Case, Battle Creek; Dr. Nelson M. Percy, Chicago; Dr. Malcolm T. MacEachern, Chicago; Dr. Allan Craig, Chicago; Rev. C. B. Moulton, S. J. Milwaukee; and Rev. F. C. English, Cleveland.

### ONTARIO AND QUEBEC

The sectional meeting of the American College of Surgeons for the provinces of Ontario and Quebec was held in Ottawa, Canada, on November 22 and 23. The headquarters for this meeting was at the Chateau Laurier. Clinics were conducted at St. Luke's Hospital, Protestant General Hospital, and Ottawa General Hospital.

The hospital conference was held in the ballroom of the Chateau Laurier on the afternoon of the first day. There was a large audience which filled the ballroom to overflowing and the program was excellently arranged and well received. Dr. A. T. Shillington, chairman of the Ontario committee, presided at the sessions.

Following the hospital conference an illustrated address on "The Organization and Work of the American College of Surgeons" was given by one of the associate directors and the following provincial committees were elected for the coming year:

#### ONTARIO

Chairman—L. J. Austin, Kingston  
Secretary—Charles A. Young, Ottawa  
Counselor—Frederick B. Mowbray, Hamilton

#### QUEBEC

Chairman—W. W. Chipman, Montreal  
Secretary—Eugene Saint-Jacques, Montreal

The community health meeting was under the patronage of Their Excellencies Lord and Lady Byng who occupied seats upon the platform. The meeting was held on the evening of the 32nd in the Auditorium of the new Collegiate Institute on Carling Avenue. The Auditorium was crowded to the doors and there was standing room only. Music was provided by the Collegiate Institute Orchestra. They played while the audience was being assembled and during the showing of the moving picture film, "The Reward of Courage" at the close. This was a very interesting and enthusiastic meeting and one of the best which the College has had. The attendance was at least seventeen hundred.

The scientific meeting was held in the ballroom of the Chateau Laurier on the afternoon of the 23rd. There was a very large attendance and an exceedingly interesting program.

The hospital clinics were splendidly organized and well carried out.

The visiting speakers were Dr W W Chipman, Montreal; Dr Franklin H Martin, Chicago; Dr George W Crile, Cleveland; Dr James T Case, Battle Creek; Rev C B Moulmker S J, Milwaukee; Dr F N G Starr, Toronto; Dr L J Austin, Kingston; Dr Oscar Klotz, Toronto; Dr Henry Gray, Montreal; Dr C B Keenan, Montreal; Dr Harry Burgess, Montreal; Dr A K Haywood, Montreal; Dr Malcolm T MacEachern, Chicago; and Dr Allan Craig, Chicago.

The local Fellows of the College are certainly to be congratulated upon the exceedingly successful meeting held in Ottawa.

On Saturday the 24th, following the sectional meeting, the director general, Dr Franklin H Martin, addressed the Canadian Club at the Chateau Laurier.



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Fig. 3. Photomicrograph, Case showing some of the early attempts at formation of glands

rapidity and complete haemostasis are so important that the lumbar route should never be employed in infants for the removal of large renal tumors.

When the abdomen is opened access to the tumor is obtained by incising the peritoneum along the outer side of the colon. On the right side care must be taken of the duodenum which lies closely applied in front and may be easily torn. After removal of the tumor it is a good plan to apply copious layers of cotton wool and complete the dressings by the application of a tight abdominal bandage. The sudden loss of intra-abdominal pressure is compensated for to some extent, in this way.

The prognosis is extremely poor. Recurrence may be expected in 80 per cent of cases within the first year after operation. If the tumor is found nodular at operation instead of smooth it may be inferred that sarcomatous changes in the interior have reached the surface, and the outlook may be regarded as bad.

After operation my own case recovered rapidly but about 6 months later there was a recurrence in the position from which the original tumor was removed and the child died within a year.

Robins (2) described a case in good health 2 years after operation but remarks that these tumors are intensely malignant, with a high rate of mortality from operation and this,



Fig. 4. Photomicrograph, Case showing striped muscle fiber

with a high rate of recurrence, brings the total mortality rate as high as 93 per cent.

Mixter (3) states that in nine cases surviving nephrectomy with one exception all showed rapid recurrence. Death occurring in from 4 months to 1½ years. The exception differed in no way either clinically or pathologically from other cases of embryoma. The child was alive and well 3½ years after nephrectomy.

Deming (4) discovered a congenital sarcoma in an infant 29 days old. The tumor was successfully removed and the child was alive and well 12 months afterward.

#### PATHOLOGY

*Naked eye description.* The tumor was of an irregular oval shape. It measured 14.5 centimeters in its greatest diameter and weighed 3½ pounds. The greater part of its surface was covered by a thin, glistening membrane, serous in character. Where the membrane was absent the tumor appeared to be lobulated, uniformly hard in consistence and of a grey color with areas of a reddish tinge scattered here and there. The remainder (the part covered by the membrane) was smooth, and similar to the exposed portion as regards its consistence and coloration. At one part an elevation was produced by the membrane lying over the kidney which was therefore partly attached to the tumor by this layer. When the membrane was slit up over this area, the kidney was found to be partially embedded in the tumor and its lower pole appeared to thin out gradually and blend with the tumor substance. The amount of kidney tissue which was not embedded was equal to about half the organ. This part was 5 centimeters long and showed the usual lobulations.





Fig 5. Case . Squamous celled carcinoma with pyonephrosis and stones. dilated calyces with stones, b showing here the section as made from the pelvis into the tumor mass.

present in young children. When cut in various planes the tumor as seen to be divided into lobules by fibrous septa. The lobules varied in size and some areas appeared to be composed entirely of fibrous tissue. As on the surface, red areas were present in places. The consistency of the tumor was similar to that found in uterine fibromyomata. Small red areas were noticed which differed in appearance from the surrounding dense tissue. They were of deeper color and somewhat softer (compared with the adjacent parts, they formed contrast similar to that between the mucous membrane and the body tissue of the uterus).

Professor A. C. O'Sullivan kindly examined numerous sections made from different parts and reported as follows:

*Microscopic Report.* There was a good deal of variety in the appearances found in different parts of the tumor. In some places there was an arrangement of short spindle cells in kind of network with spaces between them. In others there were long spindle cells with oval or rectangular nuclei arranged in parallel bundles. In others again there were aggregations of mixed round and spindle cells. In cross section, and in the middle of these aggregations, more or less complete attempts at formation of gland-like looking structures, such in early stages of their formation, were only distinguished from the surrounding cells by their more regular arrangement. The most remarkable appearance, however, was that of long narrow fibers running in parallel bundles containing nuclei of narrow rectangular shape, sometimes quite close together at other times with considerable interval between them. These nuclei lay applied to the outside of the fibers. The general appearance of these fibers was not unlike that of a non-medullated nerve fiber but they stained the

characteristic brownish-yellow of muscle fibers with Van Gieson, and in places showed most distinct transverse striation. In the areas mentioned above of network of spindle cells, one found here and there the same yellowish brown staining of the bodies of the cells. The nuclei were exceedingly thin walled and parts of the tumor showed evidence of edema—soft and juicy. Between all these various arrangements of cellular material lay sometimes clear spaces at other places very fine felted network of fibers something like neuroglial fibers in their arrangement but staining bright pink with Van Gieson. The greater part of the tumor consisted of muscle fibers. The appearances are those of the rhabdo-myoma described by various writers, and these tumors have now been observed with sufficient frequency to find their way into the textbooks of Jung and Hausmann.

Fraser (5) found that six different tissues enter into the formation of these tumors: true renal tissue, adenomatous tissue, sarcomatous tissue, non-striped muscular tissue, connective tissue, vascular tissue, and to these may be added a seventh in the present case, striped muscular tissue. He states that an examination of the adenomatous tissue gives convincing evidence that this portion of the tumor has been embryonic in origin.

*Case 2.* Squamous celled carcinoma. A woman, age 46, was admitted to Mercy Hospital last March. For a number of years she had been treated for bladder trouble, with irrigations, etc., and she stated that these troubles commenced with an attack of Malaria fever. Twelve years ago she suffered from severe pains off and on in the left lumbar region but lately in addition to painful micturition, she noticed that the urine was muddy and dark colored, and she came to the hospital for advice.

After routine examination and analysis of her history it appeared to me that this was a typical renal calculi case. The urine contained blood cells, pus cells, etc. in abundance. The cystoscope revealed pus shooting through the left ureter and finally a X-ray photograph demonstrated multiple calculi in the kidney. The photograph showed four stones in the upper pole, ten in the lower pole. The pelvis, ureter and bladder were free.

The kidney was exposed by the usual lumbar route, and was found so disorganized that nephrectomy was performed.

The pathological report surprised us by stating that, in addition to calculus pyonephrosis, tumor was present which on microscopic section, proved to be squamous celled carcinoma. A series of sections demonstrated the transition from pelvic to squamous epithelium. In the addition of squamous cells embedded in dense fibrous tissue in the capsular area. Infiltrating strands of squamous epithelium with pearl formation were present among the



Fig 6



Fig 7



Fig 8



Fig 9

Fig 6. Photomicrograph, Case 2, showing the squamous epithelium lying deep to the epithelium of the pelvis. Fig 7 and 8. Case 3. Photomicrographs of the transition from pelvic to squamous epithelium.

Fig 9. Case 4. The appearance in the capsular area, showing the islands of squamous cells embedded in dense fibrous tissue.

trophic and fibrosed glomeruli and tubules. A section of the pelvis stained with pyronin in thylgreen showed clusters of plasma cells.

From the surgical literature it appears that squamous celled carcinoma of the kidney in the region of the pelvis is very rare but arises in the great majority of cases in which calculi are already present. It is another example of the development of cancer as a result of prolonged irritation. It may be that a number of cases of squamous celled carcinoma have not been recorded and that the rarity of the condition is more apparent than real. Neglect in

making routine microscopical examinations of specimens removed which at first sight, appear to be only common examples of calculus nephritis might explain a miscalculation of this kind.

William Mayo (6) states that, of all cases of epithelial cancer of the kidney which came to operation, not less than 50 per cent were demonstrably superimposed on extensive renal calculus formation.

Bugbee also states that the rôle of infection and nephrolithiasis in the etiology of carcinoma of the kidney is suggestive.

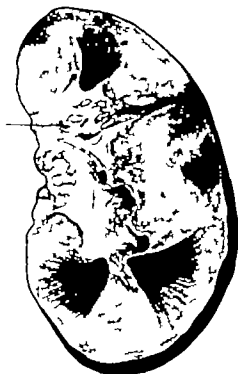


Fig Drawing showing angioma of kidney at

Graves and Templeton (7) report two cases of combined tumor of the kidney in which there were neither calculi nor evidence of chronic pyelitis.

Wells (8) referring to squamous celled carcinoma of the kidney pelvis, states that the formation of keratinising squamous celled carcinoma in the renal pelvis is a rare occurrence and in a case reported by him the metaplasia of the transitional epithelium to the squamous form was apparently the result of chronic irritation from renal concretions.

Newman (9) records that squamous celled carcinoma is very rare and refers to a case published by Kundral and Halle, who suggested the idea that these growths are plaques of leucoplakia which have as a consequence of local irritation taken on malignant action. The irritation may be the presence of a stone in the pelvis or bacterial infection. The tendency of these growths is to bleed. In fact, it is the rule, so that hematuria is the only early indication of the disease.

According to this Newman authority when the ureter becomes excluded by clot, or if its walls become involved in the disease, other symptoms develop, such as renal pain and swelling. He had not seen any cases of squamous celled cancer of the renal pelvis, and after a careful search of the literature he was able to discover only nine properly recorded cases.

In most, if not all of the few cases of squamous celled carcinoma reported in the literature, the transition from one epithelium to the other appears to have been directly brought about by the presence of infection and of stones.

Cumming (10) discusses leucoplakia of the renal pelvis and the metaplasia resulting in the formation of stratified epithelium. Dr McCarty of the Mayo Clinic tells me that in 1648 kidneys which came to operation in 10 years 7 epitheliomata were found.

**CASE 3. Angioma (Fig )** Last March clergyman age 57 without previous warning or any signs of ill health, developed severe urinary hemorrhage.

There was no pain, tenderness, or other indication of the site of the bleeding. The urine passed had the appearance of pure blood. Attempts at cystoscopy failed; it was impossible to free the bladder of blood even for a moment and the examination ended without having ascertained whether the bleeding was from the bladder or of renal origin. X-ray photographs were taken with negative results. There was no pus and no micro organisms in the urine, and renal growth was suspected.

An effort was made to check the hemorrhage by the administration of horse serum, morphia, calcium and by blood transfusion, with only partial success. On the sixth day the urine was much clearer but after palpation of the left renal region the patient stated that he felt that the hemorrhage was commencing again, and red blood was almost immediately passed from the bladder. It was now evident that palpation had excited the hemorrhage.

The patient was by this time suffering severely from loss of blood and, notwithstanding blood transfusion, there was profound anemia, and an operation was undertaken with some anxiety. The kidney was found enlarged and cyanosed; the pelvis was distended with blood clot, but the source of the hemorrhage in the kidney was impossible to ascertain. The pedicle was clamped, ligatured and the kidney rapidly removed. Recovery was untroubled, and the patient is now well.

On examination of the specimen, small scarlet or purplish clusters of vessels, as described by Verboven, were found in the renal tissue immediately under the

capsule. Under the mucous membrane of the pelvis an angiomatous tumor resembling renal varix was discovered but was due to a proliferation of small and medium sized blood vessels forming a rich arterial plexus.

In this case, it was possible to see the blood, on cystoscopic examination, flowing in considerable quantity from the left ureter. On section an angioma was found occupying the third uppermost calyx, but it could not be seen when the organ was *in situ*, although it was bleeding freely.

Newman records a very similar case of angioma of the renal pelvis with hæmaturia no X ray shadow no enlargement of the kidney bacteriological examination negative, and nephrectomy with good result.

Swan (11) describes a case of sudden profuse hæmaturia without any preceding pain. The kidney was removed and divided in length, when a spongy mass was seen in the central part oozing blood freely from the surface. On microscopical section the renal tissue was found infiltrated with blood around an area showing the structure of an angioma.

Sir Henry Morris (12) book records the postmortem finding of multiple angiomas of the left kidney one of which had ulcerated into the upper calyces. To the naked eye, the cut surfaces showed the open mouths of two or three large vessels with a wide zone of cavernous tissue surrounding them. Microscopically these areas were composed of a collection of vascular spaces, as in an angioma.

Sennels (13) reports two cases of renal angioma. In the second case a malignant papilloma of the bladder was subsequently found and the nature of the original tumor of the kidney is, therefore, open to some doubt. The first case resembled very closely the case now reported. The absence of pus and bacteria and the free bleeding led to the diagnosis of tumor.

#### PATHOLOGICAL REPORT

CASE 3. Angioma of the kidney. The hemorrhagic areas on the surface were seen to be in the

tissue of the kidney and not between it and the capsule. Toward the upper pole was a yellow nodule the size of a small pea, which was found to be composed of tissue similar to that of the suprarenal cortex and was apparently a small adrenal rest. This finding was a coincidence and had no significance. The pelvis was found full of blood clot and the lining was blood stained. At the upper end of the pelvis a plexiform mass of thick walled vessels was observed occupying an area of about 5 centimeters in diameter. In the hemorrhagic regions the renal epithelium had undergone very extensive degeneration. Some hyaline glomeruli were present. Many of the tubules were packed with blood cells and extravasations into the surrounding tissue were numerous. The plexus was composed of thick walled arteries.

A difficulty arises in cases of renal angiomas. The condition is only discoverable after nephrectomy. The bleeding might equally well arise without pathological change in the renal tissues, and be the so called "essential hæmaturia" which can be treated successfully by decapsulation and other conservative methods. It is noteworthy that in the recorded cases, the left kidney was affected and that the angiomas in each instance were placed in much the same situation.

In the Mayo Clinic to date only one case of angioma of the kidney has been observed. This was verbally reported by Dr. McCarty.

I am indebted to Dr. E. C. South, Pathological Laboratory of Trinity College, for the pathological reports and for the illustrations.

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## PRIMARY SARCOMA OF THE PENIS

## REPORT OF A CASE WITH A REVIEW OF THE LITERATURE

By JAMES J. JOHNSON, M.D. BOSTON

From the Urological Clinic of the Peter Bent Brigham Hospital

ON September 5, 1922 a Swedish laborer 57 years of age was admitted to the clinic giving the following history:

Ten years ago he first noticed small articular growth on the left side of his glans penis, near the corona. This he cut off himself with a pair of scissors. He did not notice anything further until 8 months before admission, when a small reddish nodule appeared at the site of the original wart. This grew quite rapidly and in 3 months had reached a size of about 3 centimeters in diameter. He consulted a local physician who cut the growth off under local anesthesia without any further treatment. The tumor soon began to grow again and in 3 or 4 months had reached its previous size. He now went to another physician who excised a small piece of tissue for microscopic examination and sent it to a laboratory where a diagnosis of sarcoma was made. Following this biopsy, which was done 6 weeks before admission to the hospital, the tumor grew very rapidly gradually involving practically the entire glans penis and pushing the external urinary meatus far over to the right. At no time had he had any difficulty in urinating. He had lost no weight or strength and had been working every day until admission.

His family and past histories were irrelevant. There had been no previous history of injury or phimosis. He denied venereal disease. Examination of the penis revealed a large red, fungating, kerated tumor which had involved the entire glans and pushed the prepuce back. The tumor was 6 to 7 centimeters in diameter. A yellowish foul discharge was present. The urinary meatus had been displaced entirely over to the right side so that the urinary stream which was moderately decreased in caliber but forceful, came from the tip of the corona. The shaft of the penis appeared normal and showed no evidence of extension of the growth. The inguinal nodes on both sides were definitely enlarged (Fig. 1).

General physical examination was negative and together with the X-ray examinations revealed no evidence of metastasis to the lungs, ribs, pelvic bones, or long bones.

The blood Wassermann was negative, the hemoglobin 85 per cent, the red count 4,500,000. On September 9, 1922 under nitrous oxide and oxygen anesthesia, dissection of the inguinal nodes and an extirpation of the penis with transplantation of the urethra was done after the method described by Cunningham.

The patient had a very smooth postoperative course. A slight amount of wound infection occurred, but this was readily controlled. He was discharged in good condition about 3 weeks after operation.

Since his discharge the patient has been followed very carefully. He is doing very well, has no complaints, and has gained some weight. The penile urethral orifice is not strictured, and urination is unimpaired. When last seen (May 2, 1923) 8 months after operation there was no evidence of recurrence or metastasis to be found clinically or by X-rays of the lungs, skull, entire spinal column, ribs, pelvic bones, and of the bones of the extremities.

**Pathological report.** The following is Dr. S. B. Wolfbach's description of the specimen. Gross description. Specimen consists of several masses of fat tissue removed from the groin and a penis. Palpation of the fatty tissue reveals several discrete, firm masses measuring up to 1 centimeter in diameter. These are apparently lymph nodes. On section the nodes are somewhat firmer than normal and are grayish in color with here and there a whitish firm area, probably metastases. Fixed in Zenker.

The penis which contained tumor weighs 35 grams and measures 3 centimeters in length. Surrounding the glans penis so that it is not discernible is a large fungating tumor mass 7 centimeters in width and extending back over the penis 3.5 centimeters. The tumor mass is made up of irregular nodular areas varying from 2 to 3.5 centimeters in diameter. The color varies from reddish gray to a sort of greenish gray in the center of the tumor mass. It is very soft, friable, and in areas is covered by a grayish fluid. It has an exceedingly foul odor. The skin immediately adjacent to the tumor is markedly thickened. The remainder of the penis appears normal. Several small portions of the tumor are taken for microscopic diagnosis, the remainder is preserved in Kahler's solution as gross specimen (Figs. 2 and 3). Microscopic examination. Six sections of lymph nodes show normal germinal centers and lymph sinuses. There is an increase of fibrous connective tissue in one section. There is no evidence of tumor metastasis.

There are sections from various portions of the tissue and penis stained with eosin-methylene blue, phosphotungstic acid-haematoxylin, almbae blue connective tissue stain and Van Gieson stain. The tumor as a whole is fairly uniform in structure. The cells are for the most part elongated fusiform, or spindle shaped. The special stain shows in most places traces of collagen between the cells, and in a few places the collagen is fairly abundant. It is



Fig. 4. Appearance of the lesion on application of the patient to the clinic. The tumor was large red, fungating mass, pushing back the prepuce.



Fig. 5. Side view of the gross specimen, actual size showing the sarcoma involving practically the entire glans and pushing back the prepuce.

evident that the tumor is growing rapidly as there are many mitotic figures. There are also numerous multipolar mitoses. Just beneath the ulcerated surface the tumor cells take a number of shapes, round and ovoid on cross section with rather large nuclei. The tumor cells here appear somewhat necrotic and are invaded by some polymorphonuclear leucocytes. At the base the tumor is fairly sharply outlined, but close inspection shows that its peripheral portion consists of elastic tissue derived from the tunica, and careful examination shows it definitely invading. In the mass of tumor itself there is no recognizable normal tissue except blood vessels that are completely rounded by the tumor and which show infiltration of their walls by tumor. There are several cross sections of the corpora cavernosa posterior to the tumor including the dorsal vessels and lymphatics. There is no evidence of tumor in these sections (Figs. 4, 5, 6). Diagnosis: Fibrosarcoma of glans penis.

#### REVIEW OF REPORTED CASES

A careful search of the literature has revealed only thirty five cases of sarcoma and endothelioma of the penis. Of these, one is reported as a fibro-cellular tumor, two as fibrosarcomata, two as spindle cell sarcomata, four as mixed cell sarcomata, seven as round cell sarcomata, eight as melanosarcomata, and nine as endotheliomata. Two are not classified. The first of these is the case of Mr. Seymour Sharkey who reported having seen a case of sarcoma of the penis but remembered none of the details other than that it had been clinically diagnosed as an epithelioma and was a spindle cell sarcoma. The other is Podrazik's case which is men-

tioned briefly by Jacobson. This patient lived only a year after the onset of the tumor and had inguinal gland metastasis. Unfortunately Jacobson does not give the reference to the original article and I could find no mention of it anywhere else.

Weir reports a case of rare form of cancer of the penis" which clinically appears to be a sarcoma, but histological diagnosis is wanting. Si-Mohamed's article is entitled "Sarcoma de la verge" but his histological report is merely "lobulated epithelioma" without any further description. Vopel reports three

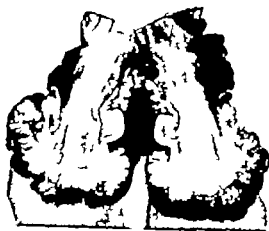


Fig. 6. Sagittal view, actual size, of distal portion of the penis. The sarcomatous involvement is seen to be mainly limited to the glans although it slightly invades the distal ends of the corpora cavernosa.

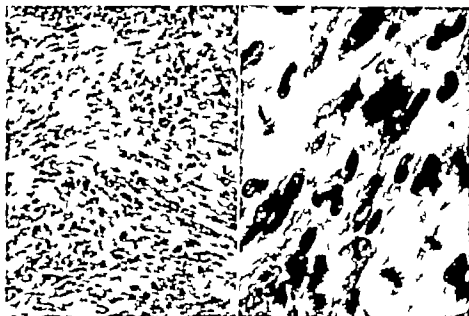


Fig. 4 (at left) Showing general structure of tumor which as a whole was quite uniform. X 200

Fig. 5 Showing the elongated spindle shaped type of cell. A mitotic figure is seen. These were numerous and frequently multipolar. X 35

cases of sarcoma of the penis, but in only one of these (Case 3) is there sufficient evidence to tabulate it among the reported cases. In the other two cases the prostate was so extensively involved in the tumor mass that the author leaves the question open as to whether or not the tumor was primary in the penis. In addition there are no satisfactory histological reports in these two cases.

The great majority of these cases occurred in men of the "cancer age" but four occurred in younger adults, one in a boy of eight, and two in infants. The most common subjective symptoms were pain in penis or perineum, dysuria and occasionally acute retention of urine. The majority of the cases of endothelioma had priapism with an enlarged penis as if in semi-erection.

As a general group sarcoma of the penis is a very malignant tumor as is indicated by the following figures. Unfortunately the follow-up period had been very short at the time when most of these cases were reported and therefore the number of 3 or 5 year cures cannot be determined.

Duration in patients who were living at the time case was reported—

	Cases	Total
Living to 5 years after onset		
Living 6 to 10 years after onset		
Living to 5 years after onset (One case has recurrences)	5	
Living 6 months to 1 year after onset (One case has recurrences)		
Living less than 6 months after onset	9	

b. Duration in patients who are dead at the time the case was reported—

Lived to 5 years after onset		
Lived 6 to 10 years after onset		
Lived to 5 years after onset	4	
Lived 6 months to 1 year after onset	4	
Lived less than 6 months after onset	4	12

Cases in which total duration was not stated

9
Total 36

Tables I, II, III and IV summarize the reported cases obtained from the literature.

The cases in Table I are less malignant than any of the other groups. These tumors do not metastasize freely but do tend toward

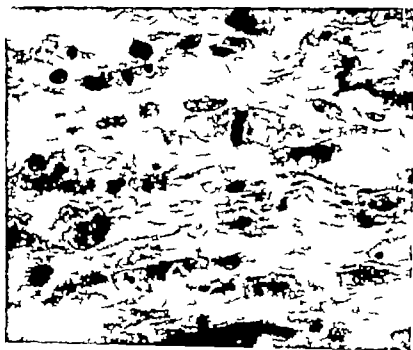


Fig. 6. Van Gieson stain. The wavy fibrillary intracellular substance is revealed. A mitotic figure appears.  $\times 50$ .

local recurrences. The majority of them take origin from the corpora cavernosa less often from the sheath of the corpora than from the erectile tissue. However two take origin from the glans penis. Eight of these cases had a simple excision of the tumor done first, but in all of these except one, a more radical procedure such as amputation or extirpation was later necessary because of local recurrences.

The round cell sarcomata (Table II) are more malignant than the previous group and metastasize earlier and more freely. The great majority of these also started in the corpora cavernosa.

The melanosarcomata (Table III) also metastasize freely but as is indicated by the longer duration before operation, do not grow as rapidly as the round cell sarcomata. In all of these cases the tumor takes its origin at the distal end of the penis either the glans or the prepuce.

The endotheliomata (Table IV) form the largest single group. They appear to be very malignant and rapidly growing tumors.

#### SUMMARY

A case of fibrosarcoma of the glans penis of 2 years duration is presented. Two local excisions and a biopsy had been performed. No evidences of metastases were apparent. Eight months after complete extirpation of the penis with dissection of both groins there was no evidence of recurrence or metastases.

Thirty five cases of sarcoma of the penis are collected from the literature and are tabulated. Of the entire series 9 cases fall into the group generally known as endotheliomata, the most malignant type. Seven fall into the group of round cell sarcomata also a very malignant type. Eight fall into the general group of melanosarcomata, a definitely malignant but more slowly growing tumor. Nine of the collected cases appear to be spindle or mixed cell sarcomata and tend to have a relatively low degree of malignancy. Our case belongs to this latter group.

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Reported by	Pathological diagnosis	Age	Point of origin	Metastases	Days from last operation	Type of operation	Result	Total time last	By symptoms and remarks
Hutchinson 1914	Non-ciliated tumor	3	Cervix cancer metastases	None	no data	Local excision	Living about 2 months after operation	4 yrs	Rapidly growing tumor of cervix in the region of the lower 1/2 of the cervix. Tumor contained an area of tumor cells through and beyond any attempt at removal. Tumor cells were found in the lymphatic vessels but not in the ordinary connective tissue of the cervix.
Beck 1911	Fibrosarcoma	46	Cervix cancer metastases	Local recurrence	3 yrs	Chemical amputation	Living 2 years after first operation	1	After 4 years the growth became very rapid. In 1/2 of the cervix which was removed by amputation. Recurrence in the cervix required an amputation.
Plummer 1914 1916	Fibrosarcoma (malignant cell)	43	Cervix cancer metastases	Local recurrence	1 1/2 yrs	Local excision	Living 2 years after first operation	4 yrs	Mixed tumor for some time mostly with epithelial part. Operation but not removal of metastases in both cervix and uterus. Cervical metastases in the cervix.
Porter 1916	Large cell	44	Cervix cancer metastases (possibly from uterus)	None	none	Excision	Died one week after operation	6 mos	Very early growth in the region of the cervix of the uterus. Extensive tumor involving 1/2 of the uterus. Total of extensive transformation.
Coll 1914	Spindle cell	46	Cervix cancer metastases	Regional lymphatic nodes (no evidence of metastases)	none	Excision of uterus and transformation of cervix	Died 1 1/2 weeks after operation	10 mos	Reported as small papule on the dorsum of the foot and later rapidly.
Judson 1911	Fibrosarcoma (malignant cell)	27	Os uteri cancer metastases	Local recurrence	3 yrs	Local excision	Living 8 mos after operation	35	No symptoms other than tumor. Extensive tumor involving 1/2 of the cervix. Tumor cells were found in the lymphatic vessels but not in the ordinary connective tissue of the cervix. Tumor cells were found in the lymphatic vessels but not in the ordinary connective tissue of the cervix.
Parvick 1911	Round and spindle cell	44	Os uteri cancer metastases	Local recurrence	1 1/2 yrs	Local excision	Living 3 years after first operation	1 1/2 yrs	37% metastatic tumor of cervix and uterus. Tumor cells were found in the lymphatic vessels but not in the ordinary connective tissue of the cervix. Tumor cells were found in the lymphatic vessels but not in the ordinary connective tissue of the cervix.
Berth 1911	Spindle and round cell	40	Left cervix	Os uteri cancer metastases	3 yrs	Excision of tumor	Died one week after first operation	7 yrs	Difficulty in operation and amputation of tumor. Tumor cells were found in the lymphatic vessels but not in the ordinary connective tissue of the cervix. Tumor cells were found in the lymphatic vessels but not in the ordinary connective tissue of the cervix.
Hildner 1911	Round and spindle cell								The tumor locally recurred in the cervix in the end of 1/2 of the cervix. Tumor cells were found in the lymphatic vessels but not in the ordinary connective tissue of the cervix. Tumor cells were found in the lymphatic vessels but not in the ordinary connective tissue of the cervix.
Key 1911	No cell and spindle cell (epithelial)		Os uteri cancer metastases	Local recurrence	3 yrs	Amputation	Living 2 years after operation	7 yrs	Small epithelial tumor excised 4 mos before death by Key. Recurrence in 1/2 of the cervix. Tumor cells were found in the lymphatic vessels but not in the ordinary connective tissue of the cervix. Tumor cells were found in the lymphatic vessels but not in the ordinary connective tissue of the cervix.



TABLE III—CASES REPORTED AS MELANOTIC TUMORS

Reported by	Pathological diagnosis	Age	Point of origin	Melanosis	Duration of melanosis	Type of operation	Result	Total duration	Symptoms and remarks
Talbot 1877	Melanosis of the appendix (cell)	1	Colon (fecal concretions)	Regional lymph nodes of the appendix	8 yrs	Amputation	Recovered from operation but no further attack of melanosis		Single dysentery. Remained in good health until death at the age of 18. Melanosis attended by chronic catarrh. Slightly enlarged appendix.
Child 1886	Melanosis of the appendix		Colon (fecal)	None	7 yrs	Amputation			Dysentery. Shortly growing black tumor on skin around which several small tumors had formed.
Marshall et al by Clark	Melanosis of the appendix	14	Pecore	Local lymph nodes of the appendix and the cecum		None	Died 7 yrs after onset with melanosis	7 yrs	Remained in good health until the age of 18. Then melanosis attended by the formation of black tumors in the cecum and the sigmoid colon.
Osborne and Clark 1886	Pigmented melanosis (melanotic cell)					Amputation			The case is briefly mentioned by the author at a meeting of the Pathological Society. He further states that he is of the opinion that the patient recovered from the operation.
Peter 1887	Melanosis of the appendix (melanotic cell)	11	Colon (fecal concretions)	Regional lymph nodes of the appendix and the cecum	10 yrs	Amputation and dissection of both glands	Living 7 yrs after operation but has melanosis of the skin of the abdomen	17 yrs	Delicately pigmented, dark brown. Tumor began to bleed upon the skin. At operation melanosis was in form of small, of typical nodules and adherent to and growing into villi.
Moss 1894	Melanosis of the appendix (cell)	11	Colon (fecal concretions)	Local lymph nodes of the appendix and the cecum	7 yrs	Amputation	Died 7 yrs after operation	8 yrs	Began in black pigmentation on skin and gradually increased. At operation melanosis was in form of small nodules and adherent to and growing into villi.
Perry 1894	Melanosis of the appendix (cell)	44	Colon (fecal)	Regional lymph nodes of the appendix and the cecum	7 yrs	Local excision, amputation and dissection of both glands	Died 7 yrs after operation with multiple melanosis	14 yrs	Started as small spot on skin, but was in constant growth. At operation melanosis was in form of small nodules and adherent to and growing into villi.
Peter 1894	Melanosis of the appendix (cell)	70	Colon (fecal)	Regional lymph nodes of the appendix and the cecum	10 yrs	Amputation and dissection of both glands	Died 7 yrs after operation with melanosis	77 yrs	Pigment, followed by other growths, dependent on melanosis. These growths were black tumors of the skin and were in the form of small nodules and adherent to and growing into villi.

TABLE IV.—CASES REPORTED AS ENDOTHELIOIDOMA

Reported by	Pathological diagnosis	Age	Point of origin	Metastases	Days from before to after onset	Type of operation	Result	Total days alive	Symptoms and remarks
Morgan 1897	Endothelioma	20	Carpus carpi non	Regional lymph nodes. Many distant metastases to all organs and all bones.		None	Died 20 days after onset	non	Very rapidly growing tumor. No symptoms from metastases in some sections. No change in shape.
Tregel 1897	Endothelioma	16							Autopsy from pathological report but primary tumor not found. Several other metastases in this case.
Alexander 1903	Endothelioma	20	Carpus carpi non	None seen	6 mos	Excision	Died 14 yrs later cause not known	273 mos and 10 mos	Painless lump on dorsum of penis extending to scrotum. Carpus carpi tumor (this an endothelioma) enlarged to size of a walnut. Extension of the lymph spaces rather than of the connective tissue.
Hildebrand 1903	Endothelioma (1)	44	Carpus spinae non	None	37 +	Excision	Lying at 14 yr after operation without recurrence	37 +	Lump on under surface of penile skin extending to scrotum. Only symptoms were terminal swelling. Hildebrand believed the endothelial diagnosis with carcinoma of the penis but never made a carcinoma of the penis. Carpus carpi tumor (this an endothelioma) enlarged to size of a walnut.
Cobbins 1903	Endothelioma	20	Carpus carpi non	Heart, pericardium, lungs, liver, spleen, lymph nodes	non	Amputation	Died 20 days after onset	non +	Painful carcinoma. Dorsal vein of penis found to be involved by tumor.
Cobbins 1903	Endothelioma	20	Carpus carpi non	Heart, pericardium, lungs, liver, spleen, lymph nodes	non	Amputation	Died 14 mos after onset	non +	Painless tumor larger than normal, erect, dilated vein on dorsum. Carpus carpi tumor (this an endothelioma) enlarged to size of a walnut. Differential diagnosis between endothelioma and carcinoma of the penis. Carpus carpi tumor (this an endothelioma) enlarged to size of a walnut.
Cobbins 1903	Endothelioma (1)	273 mos and 10 mos	Carpus carpi non	None	8 days +	Amputation			Another grave very few clinical details, as in many made. Postoperative examination of penis of tumor sent to him by colleague.
Morgan 1903	Pericardial sarcoma	20		None clinically	14 yrs				Marked dyspnea and difficulty of urination. Carpus carpi tumor (this an endothelioma) enlarged to size of a walnut. Carpus carpi tumor (this an endothelioma) enlarged to size of a walnut.
Polakoff 1903	Endothelioma	65	Carpus carpi non	None clinically		None	Died 7 mos after onset	7 mos	Marked dyspnea and difficulty of urination. Carpus carpi tumor (this an endothelioma) enlarged to size of a walnut. Carpus carpi tumor (this an endothelioma) enlarged to size of a walnut.
Cobbins 1903	Endothelioma	10 mos	Carpus carpi non	Regional lymph nodes		None	Died 20 days after onset	non	Marked enlargement of penis, which was firm as in a section.

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PATHOGENESIS AND TREATMENT OF SO-CALLED CONGENITAL CEREBRAL HERNIAE<sup>1</sup>

By Dr. F. M. LAMPERT Moscow, R. S. S. R.  
From the Surgical Clinic of the First State University of Moscow

**S**O-CALLED congenital cerebral herniae are generally classified as encephalocele and exencephaly, the difference between these two conditions being rather a quantitative one.

In exencephaly a larger or smaller portion of the brain substance becomes dislocated through an opening in the cranium. It may be looked upon as an ectopy of the brain and is but of a teratologic interest, as it is incompatible with life and the surgeon is seldom called upon to deal with this morbid condition.

Encephalocele might be defined as a tumor-like formation originating in the brain and its meninges. Both are rare diseases, the statistics showing but two or three cases in 10,000 newborn children.

The most frequent location of the cerebral herniae is in the mesial line of the cranial vault, in the frontal or occipital region. Herniae of the base are quite rare, while lateral herniae are said not to exist at all. These are rather pseudo-traumatic formations occurring during labor, for instance.

## REPORT OF CASES

**CASE 1:** A girl, 1 month old, of good mentality was brought to a military hospital with a tumor in the occipital region of the skull. The tumor was round and occupied the external occipital tuberosity and extended down the spine. It had a pedicle 2 centimeters long. The skin covering the new growth was thin, could be folded, and was covered with thin hair which was quite abundant over the rest of the head. The tumor was transparent to light, quite painful on pressure but could not be reduced in size by compression nor could it be pushed back. The child could not lie on its back on account of pain. Puncture yielded a transparent pale yellow fluid which was not studied in detail. An operation performed 9 days after the examination revealed a bone defect in the occiput below the external tuberosity 1 to 2 centimeter in diameter. In the center of the gap there was an opening of 5 millimeters. This was covered with a solid shiny band extending from the skull cavity to the tumor. The latter was removed and the band replaced into the cranium. The postoperative course was marked by

an elevated temperature and abundant discharge of the cerebrospinal fluid. On the seventh day the temperature became normal and on the eleventh day after the operation the child was discharged in a good condition. When seen 6 months later it was perfectly well. The pathological examination of the removed tumor showed it to be thin-walled containing fluid and some coagula. The cavity of the pedicle had a polyp-like thickening which consisted of brain and connective tissue (blood vessels, dura, and pia). Neuroglia was found around the blood vessels which formed plexuses and somewhat resembled ependymal cells. The brain tissue was dotted with numerous nuclei of various sizes and form. In some places the neuroglia invaded by connective tissue fibers contained blood vessels capillaries and perivascular spaces.

The superficial layers of the pedicle showed inflammatory phenomena (leucocytes, fibrin). The inner surface of the cyst was represented by the meninges especially the dura which was richly vascularized. The epithelium of the skin was thinned, the papillae obliterated, the stratum corneum very much atrophied and in some places entirely absent. Sudoriferous and sebaceous glands were in some instances much altered and atrophied. The coagula consisted of fibrin enclosing some leucocytes.

The foregoing polypous thickening is to be looked upon as a glioma (ependymal) most likely as a result of maldevelopment, while the presence of ependymal cells indicated that they became dislocated in the embryonic life of the patient. In addition, one should take into consideration the following factors: (1) disturbances of the lymph and blood circulation, as the result of the disorder of the physiological equilibrium of the tissues; (2) defects in the meninges which control the cerebral circulation; and (3) the increased intracranial pressure. This last might be the result of increased secretion of the spinal fluid by the choroid plexus because of its disturbed blood circulation. It may result in a serous meningitis, accumulation of lymph in the subarachnoid space and ultimate formation of a meningeal cyst. Being constantly filled with fluid, it increases in size, the walls becoming tense, thinned, and atrophied. These factors often cause a rupture of the tumor.

Mesodermal changes consisted in proliferation of connective tissue and blood vessels, both replacing the neuroglia tissue.

In short, the etiological factors in this case were (1) dystopy of the brain elements; (2) incomplete closure of the skull because of the mechanical obstacles brought on by the dystopy; (3) protrusion

sion of the meninges with formation of meningeal cyst partly because of disturbances of lymph and blood circulation and the consequent increased intracranial pressure.

The diagnosis in this case is hydrocephalus meningocele occipitalis inferior.

**CASE.** Boy 14 years old, a full term child, entered the hospital with a large tumor over the base of the nose. At the time of birth it was the size of a button, and located on the side of the nose. It was gradually getting larger.

Examination showed a well developed boy unable to speak. On the face there was a somewhat tuberous tumor attached to the nasal bones. It was soft, at some points transparent at others pulsating. The base was broad and fixed. Compression did not reduce the tumor nor did it influence or affect the radial pulse. It was, however, very painful. The skeletal bones as well as the skull showed no bony malities. An operation performed 8 days after the admission showed that the tumor located at the internal region of the orbit was separated from the bones. The nasal bones at their base were broken through and turned upward. The tumor which extended into the skull cavity could not be removed and as resected at the base. Child died 3 days after the operation.

**Microscopic examination.** The surface of the tumor was represented by a normal skin containing glands and papillae. The corium exhibited large quantities of unstriped striated muscles and lymphatic loci of neuroglia tissue were present around the sudoriferous glands. The further from the epidermis the more were the muscle and connective tissue replaced by nerve tissue which was lobular in structure. The interlobular spaces were invaded by cellular connective tissue muscle fibers, and blood vessels. The latter were compressing the neuroglia which showed as small foci scattered among the mesodermal tumors. The lobules themselves were invaded by connective tissue which in its turn formed lobules. A specimen from the center of the tumor mainly showed neuroglia tissue invaded and in many instances replaced by connective tissue, though not so intensely as in the previous case. Muscles were absent, but vessels and even capillaries were quite numerous in the interlobular areas of connective tissue. In another specimen, the neuroglia predominated and was richly vascularized containing numerous newly formed capillaries.

The foregoing growth should be looked upon as a dystopia that is, as the result of incomplete separation of the corneal layer from the medullary tube. The consequences of the dystopia of the brain tissue was a defect in the cranial bones, a deficient growth of glial tissue which ultimately became replaced by connective tissue.

The study of cases described by others shows that the older the tumor (cephaloma) the more connective and less brain tissue there is to be found. In fact old cephalomata

consist principally if not exclusively of connective tissue while young cephalomata, in a fetus, for instance consist of brain tissue with a tendency of the latter to be replaced by connective tissue, as shown also in the second case.

With Lissenhoff and Petroff I admit that meningocele as such does not exist, that is to say a mere protrusion of cerebral meninges with a cyst formation filled with cerebrospinal fluid is but a secondary manifestation, the primary phenomenon being dystopia of the brain. Those cases of meningocele in which no traces of brain elements could be found at all should be explained as encephalomeningocele where the brain tissue disappeared because of secondary invasion of connective tissue.

The following points should be emphasized (a) the principal location at the root of the nose and on the occiput (b) the cause of the basal cranial hernia which is incompatible with the theory of dystopia due to incomplete and irregular occlusion of the cerebral tube (c) the cause of dystopia of the medullary tube.

a. Occlusion of the medullary tube begins in the mesencephalon (middle cerebral vesicle) extending caudad and cephalad, the frontal and occipital portions, however close much later. Therefore there are greater chances for abnormalities to take place such as delayed or incomplete occlusion of the medullary tube, abnormal growth of brain tissue, with ultimate formation of cerebral hernia. A similar explanation delayed closure of the medullary tube in the occipital region, holds good also for the cases of occipital hernia.

b and c. As to those of the base of the cranium, embryological factors which cannot be discussed here in detail more or less satisfactorily explain their etiology. In general, one might say that the existence of so called anterior and posterior neuropore, processus neuroporei, canals cranio-pharyngei and occipital curvature, are sufficient reasons for the occurrence of dystopies, under the influence of trauma, pulling of amniotic adhesions or other external factors which are instrumental in the intrauterine life.

The clinical picture and course of cephalomata are variable. In some instances a

cephaloma is firmly adherent to the skin the walls are thin and tender the tumor is tense pulsating synchronously with the radial artery and is quite painful on pressure which causes respiratory troubles Especially are the above symptoms typical of cephalomata connected with the ventricular cavity (hydro-cephalocele)

On the other hand there are more benign tumors, firm to touch or cyst-like, increasing in size gradually and hardly showing any communication with the contents of the cranium

Of the general symptoms should be mentioned paralysis, mental deficiency bordering on idiocy anomalies of the cranium, defective vision headaches, hydrocephalus general marasmus Often there are present other maldevelopmental conditions, such as spina bifida hare-lip palatum fissum etc

Youth localization defective mentality disturbances of intracranial pressure anomalies of the skull and the vertebral column differentiate cephalomata from dermoid cysts, atheromata, traumatic brain hernia, etc

#### PROGNOSIS AND TREATMENT

The older statistics show that without surgical interference a bearer of cephaloma usually succumbs in early childhood Thus according to the data of Réali Schatz, and Miller out of 244 cases only 9 per cent reach a mature age If treated surgically recovery obtains in 50 to 60 per cent (Lissenkoff Beresniagovsky) Even those that survive the operation are doomed to a miserable existence for they become victims of idiocy paralysis blindness, hydrocephalus, optic atrophy unbearable headaches, separation of the bones of the skull etc The foregoing factors render the prognosis exceedingly bad whether the patient is treated or not Kehrler doubts whether it is not advisable to let an encephaloma alone

#### CAUSES OF POSTOPERATIVE DEATH INDICATIONS AND CONTRA INDICATIONS

Causes of postoperative death as given by various authors are meningitis, hydrocephalus, postoperative escape of cerebrospinal fluid, destruction of vital portions of the brain and lack of vitality that is, the patient is rendered

incapable of existence. Of the foregoing factors, meningitis is the most frequent cause of death (of 32 cases it occurred in 20) while the continuous escape of the cerebrospinal fluid interferes with the healing of the surgical wounds. Fistulæ are formed with the danger of secondary infection

As to the question when to operate, we may say that this should be done as soon as possible, for cases not operated upon seldom survive more than a year An immediate operation is indicated when the tumor grows rapidly its walls are thinned or when it is so tense that a rupture is imminent or has taken place, or when signs of marked hydrocephalus are in evidence, accompanied by characteristic clinical phenomena Some authors (Petroff Beresniagovsky) think that in the presence of hydrocephalus operation is contra-indicated It is also contra-indicated when the tumor is solid, the skin is not thinned or damaged and general symptoms are not present

In suitable cases, one should operate early Operations performed during the first week of life gave, according to Beresniagovsky 62 per cent mortality after the first month, 30 per cent To avoid sepsis, a plastic occlusion of the cranial defects according to Lissenkoff's suggestion, is the best method (a bone flap from the supraorbital portion of the frontal bone) Even plastic operations however ingenious as they might be do not prevent such complications as meningitis, conjunctivitis, etc Of the plastic methods the best one for closing the bony or bernal canal in the skull seems to be the use of a periosteal flap from the femur including the subcutaneous tissue The method of Herzen is of interest For frontal excephalomata he secures intracranial access to the inner opening of the bony canal and does an autoplasmic closure from the inside Such a method has certain advantages It prevents not only the protrusion of the stump by actual occlusion of the opening of the osseous canal but infection as well from the diseased lacrimal passages and eyes When the transplanted flap is healed the cephaloma may be safely removed In occipital cephalomata, a periosteal flap alone is sufficient

To avoid the occurrence of hydrocephalus one should watch for cerebral symptoms and



resort to lumbar puncture which in the hands of Preisch gave excellent results. In cases of hydrocephalocele the wound, after the cephaloma has been resected, should be left open and the stump submerged into the subarachnoid space if this does not prove successful a radical operation of Anton Bramann should be resorted to

#### CONCLUSIONS

1 Encephalocele is a dystopy of the medullary tube occurring early in embryonic life. It is associated with protrusion of the meninges, brought on by disturbances of lymph and blood circulation and the consequent increased intracranial pressure

2 Meningocele does not exist as a special morbid condition

3 The cause of the dystopies of the medullary tube lies in numerous embryological

factors, such as processus neuroporus, neuroporus anterior and posterior occipital curvature, canals cranio-pharyngeus and many others, in association with traumatic influences during intra uterine life.

4. Conservative treatment of encephalocele does not give favorable results

5 If operation is indicated it should be performed within the first months of life

6 It consists in radical excision of the tumor and the use of an autoplasmic flap (subcutaneous and periosteal) as well as in creation of conditions favorable for sufficient and continuous absorption of the excess of the cerebrospinal fluid and regulation of the intracranial pressure

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## HYPERCHOLESTEROLEMIA

By ABRAHAM O WILENSKY M.D. F.A.C.S. New York  
From the Mount Sinai Hospital

**A** HYPERCHOLESTEROLEMIA is one of the two etiological factors in the formation of gall stones. Hypercholesterolemias are known to accompany certain other conditions of which the most important are atherosclerosis, nephritis, and diabetes. The remarks subsequently made in this communication have reference only to diseased conditions of the liver and biliary apparatus in which these complicating factors are not present and play no part unless otherwise specified in the text.

The actual cause of the disturbance of the cholesterol metabolism leading to a hypercholesterolemia is not known. The studies of Oertel to which the views of Stadelmann and Eppinger Jr. are applicable show that some unknown activity liberated in the liver cell environment causes specific changes in the cell protoplasm leading probably to a decreased production or at least, to a lack of proper discharge of bile into the biliary passages and to a resultant retention of bile components in the blood stream. This unknown activity is undoubtedly of a chemical nature and can be initiated in one of several ways.

As a physiological phenomenon hypercholesterolemia is present during pregnancy and persists for some time thereafter in the puerperium. It is entirely possible that a distinct biological purpose is intended in which case the process may be a constructive one necessary to the growth of the fetal tissues. Such a physiological purpose is most probably accomplished through the agency of some hormone activity derived in the general environment of the pregnancy. Definite knowledge concerning this point is, however, not available at the present writing.

On the other hand the process may be entirely different. Then it must be assumed that toxic bodies are liberated in the liver cell environment and that they are intimately associated with the increased general metabolism accompanying the growth, develop-

ment and life's activity of the fetus. Just which one of the many products of metabolism is at fault is unknown.

In any case under ordinary circumstances this physiological phenomenon is so controlled as to enable the woman to compensate adequately for the abnormal increase of metabolic effort. It seems reasonable to assume from abundant clinical evidence that in the majority of cases the excess of cholesterol in the body is removed by the natural resources of the liver and that no abnormality remains which could call forth any manifestations of disease. However it is highly probable that this unusual accumulation of cholesterol bodies during the early months of the child-bearing period is the cause of the vomiting of pregnancy.

Clinically a group of cases can be differentiated in which during the course of a pregnancy or some time thereafter an attack of right hypochondriac pain sometimes with vomiting and sometimes with slight grades of jaundice, appears. Two interpretations are possible. In one, the course of affairs after the attack has subsided under appropriate treatment indicates with sufficient probability that the pain is due to changes in the liver environment (increased blood supply, congestion) associated with the handling (absorption, distribution, excretion) of cholesterol and other bodies. The association in a few of the patients of slight grades of jaundice gives a clue to the pain. A greater degree of activity causes a fairly unexpected dilatation of the bile passages and some degree of spasm at the papilla of Vater leading to a relative mechanical obstruction of slight degree. In these cases the metabolic coefficient of compensation is sufficient to overcome the disturbance, and no opportunity is afforded for the precipitation of stones.

In the following case of which I give the clinical and laboratory notes, the attacks began a short time after pregnancy.

CASE 1 Hosp No 155890 The patient age 38, had had many attacks of right hypochondriac pain. Typical attack of gall stone colic occurred while patient was in the hospital under observation. At operation a large distended gall bladder was found which contained no stones, and the walls of which showed no morphological change. A cholecystostomy, as done and biliary drainage was instituted. The laboratory facts are shown in Table I.

TABLE I—LABORATORY FINDINGS IN CASE I

	Blood cholesterol mg per cent	Bile cholesterol mg per cent	Urine bile	Blood
Pre-operative Jul 6	300			
Post-operative July 9		0.48	?	colored
9		.35	?	colored
		.28	no	colored
		.30	no	colored
		.30	no	colored
3	50	0.40	no	colored
14		.04	no	colored

In the second group the course of affairs after the subsidence of the attack indicates that the physiological effort is not sufficient to overcome the extraordinary increase of the cholesterol metabolism and the physicochemical conditions of the bile become such as to favor and cause a precipitation of stones. This was shown exceptionally well in one patient in whom at operation a single stone about 1 inch long and half as broad and thick was found in a gall bladder which otherwise was devoid of any abnormality of structure. The stone was a cholesterol stone, of a soap-like translucency, and with no trace of bile pigment in its structure.

The occurrence of bacterial infection within the liver parenchyma or in the biliary passages has been found to be associated both with normal and hypercholesterolemic conditions.

With pure infections limited practically to the gall bladder and perhaps, to the larger ducts and without obstruction in the terminal part of the duct system, normal blood conditions are always found. Apparently in these cases one is dealing with an infection of the gall bladder which has exact similarities to the ordinary types of infection of the appendix and the element of any metabolic disturbance is an entirely extraneous matter which plays no part in the pathological or clinical picture.

Indeed, no stone precipitation need occur. The notes of the following cases illustrate this type of case.

CASE 2 Hosp No 61637 A woman age 34 had had attacks of right sided abdominal colic during the 1 month previous to her admission to the hospital. There had never been any jaundice. Operation showed an empyema of the gall bladder, no stones were present. Prior to operation the blood contained 87.5 milligrams per cent of cholesterol.

CASE 3 Hosp. No 65056. A woman, age 60, for the past 30 years had complained of upper abdominal pain. For the last 4 days there had been an acute attack, with fever and vomiting and without jaundice. Operation showed gangrenous gall bladder without stones. Prior to operation the blood contained 57.5 milligrams per cent of cholesterol.

In other cases in which infection is a dominant factor stones are found in some part of the biliary tract. The notes of the following case illustrate a pure infection of the biliary tract followed by stone precipitation and without disturbance of the cholesterol metabolism.

CASE 4 Hosp No 54376 This patient had had typhoid fever when child. When 50 years of age she was admitted to the hospital with a history of indefinite upper abdominal symptoms which had been present for the preceding 7 years, but which had at no time been associated with nausea and vomiting or with jaundice. An acute attack of cholecystitis occurred twice in the 3 weeks immediately preceding admission to the hospital. Operation showed a thin walled gall bladder distended with a large number of small greenish black stones. A cholecystostomy was done and the bile drained through the fistula.

The stones contained practically no cholesterol and were composed of bile pigments. The facts obtained from examination of the blood and bile are shown in Table II.

TABLE II—LABORATORY FINDINGS IN CASE 4

	Blood cholesterol mg per cent	Bile cholesterol		Urine bile	Blood bile
		cho	sp. gr		
Pre-operative May 5	50				
Post-operative May 6		64	5	no	absent
		80	0.014	no	absent
		70	0	no	trace
3		50	70	no	colored
7	75.5		0.0350		

The great bulk of the cases of cholelithiasis are not so sharply demarcated as the illustra-

tive case just described and even when infection is a dominant factor at the time of operation the character of the clinical and laboratory data and of the anatomical findings demonstrated at operation do not always furnish satisfactory criteria for making a judgment. In some of the cases the blood contains normal amounts of cholesterol during the period of observation as the notes of the following cases illustrate.

CASE 5. Hoop No 150992. A man of 36 had his first attack of acute cholecystitis 6 days before admission to the hospital. A remission of the symptoms occurred and was followed by a recurrence. There was no jaundice. At operation a gangrenous empyema of the gall bladder was found, mixed stones were present. Prior to operation the blood contained 147.5 milligrams per cent of cholesterol.

CASE 6. Hoop No 40345. A woman, age 35, had 12 attacks of acute cholecystitis two weeks and four days before admission. There was no jaundice. At operation an empyema of the gall bladder as found, mixed stones were present. Prior to operation the blood contained 147.5 milligrams of cholesterol per 100 cubic centimeters.

CASE 7. Hoop No 5963. This patient had 10 attacks of cholecystitis 7 weeks and 1 day before admission. There was no jaundice. A gangrenous inflammation was present in the gall bladder wall, the contained bile was purulent, the gall bladder contained mixed stones. Prior to operation the blood contained 170 milligrams of cholesterol per 100 cubic centimeters.

In other cases of cholelithiasis in which infection is apparently a dominant factor at the time of observation hypercholesterolemic conditions are found in the absence of obstruction in the terminal part of the duct system and in the absence of any other complicating factors, such as atherosclerosis, diabetes, and nephritis. The notes of the following cases illustrate this type of case.

CASE 8. Hoop No 587. A woman, age 36, unmarried, had had symptoms for 9 months consisting of right hypochondria, pain and vomiting. Operation disclosed an inflamed gall bladder containing stones of mixed construction. A cholecystectomy was done. Prior to operation the blood contained 205 milligrams per cent of cholesterol, after operation 105 milligrams per cent.

CASE 9. Hoop No 53405. A woman, age 30, married, had had mild attacks of acute cholecystitis for the 9 months preceding her admission to the hospital. No jaundice was ever present. At operation the gall bladder as found full of pea and stones. A cholecystectomy as done. Prior to

operation the blood contained 27.5 milligrams per cent of cholesterol.

CASE 10. Hoop No 156563. A patient of 50 years was admitted to the hospital with a history of frequent attacks of gall bladder colic, with fever and vomiting and without jaundice. At operation the gall bladder was found the seat of a gangrenous inflammation and it was found to contain a number of mixed stones. Prior to operation the blood contained 212.5 milligrams per cent of cholesterol.

CASE 11. Hoop No 158544. A man, age 54, had an attack of acute cholecystitis which continued for the 5 weeks immediately preceding his admission to the hospital. At operation a gangrenous inflammation of the gall bladder was demonstrated and one stone was extracted from the cystic duct. Prior to operation the blood contained 240 milligrams per cent of cholesterol. Thirteen days after operation the blood contained 168.5 milligrams per cent of cholesterol. Twenty-two days after operation the blood contained 492.5 milligrams per cent of cholesterol.

The explanation for these diverse findings with practically similar clinical and pathological pictures is to be found in the biological phenomena of gall stone formation. In previous studies evidence was presented to show that in clinical medicine both disturbances of metabolism and infection are equally operative in causing a precipitation of stones and that in actual practice no one method occurs to the total exclusion of the other. In certain of the cases infection initiates the pathological process leading to calculus formation. In others, there is a primary disturbance of the cholesterol metabolism. Most commonly this disturbance originates during pregnancy.

For any individual case the available knowledge indicates that thereafter the biological sequence of events includes an infinite variety and number of combinations of infection and disturbed metabolism which may occur simultaneously or more frequently alternately and with different degrees of severity. Depending on the factor which is paramount, on the intensity of the latter's manifestations, on the stage of the process, or on the presence or absence of complicating factors, which now become numerous, the pathological picture shows wide variations and the blood shows complementary wide fluctuations of the amount of cholesterol circulating in its serum. In certain of the cases of hypercholesterolemia plus infection a vicious circle is

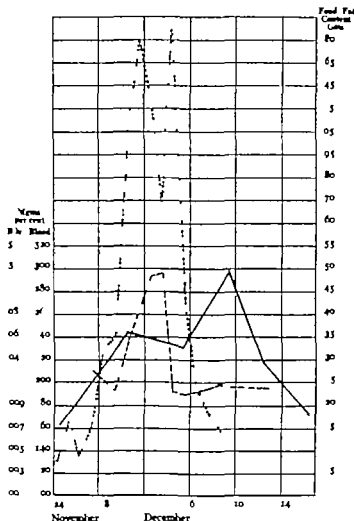


Chart I Findings in hypercholesterolemic patient in hemodialysis. Galls had been established for therapeutic purpose.  
 Blood cholesterol ——— Bile cholesterol - - - - - Food fat content . . . . .

formed by the two in that the infection by virtue of the action of the toxins thus formed in the liver cell environment interferes with the activity of the liver cell and enhances or continues the retention of cholesterol in the blood.

In such cases of manifest infection associated with gall stones, as are cited in this communication, the presence of a normal cholesterolemia indicates that at the given moment the cholesterol metabolism is work-

ing at par and that no disturbance of its activities exists. This does not, however give any inkling of the primary factor at fault, nor as to whether at any previous time a hypercholesterolemia had existed which had spontaneously corrected itself. But it is permissible to assume whenever the demonstrated stones contain a large excess of cholesterol (75 to 90 per cent) that at some previous time such a disturbance of metabolism had been present.

Under similar conditions—infection plus stones—the presence of a hypercholesterolaemia indicates that some disturbance of metabolism exists at the moment whenever no complicating obstruction is to be found in the terminal part of the duct system. When such obstruction exists one must give sufficient time for the obstruction to be relieved completely usually through operative measures before one can form a judgment as to whether the hypercholesterolaemia is due wholly or only in part to the obstruction.

Hypercholesterolaemic conditions have been observed in women in the absence of pregnancy and have also been observed in men in either case in the absence of any manifest infection. It must be assumed, therefore, that under such conditions the disturbance of metabolism is produced in other ways and from other sources. The available data give many reasons for believing that under such conditions the disturbance of the cholesterol metabolism resulting in an accumulation and retention in the blood of increased amounts of cholesterol is a fatigue phenomenon. The essential mechanism of the latter occurs in the cholesterol filter the liver cell. Overactivity of the liver cell which is usually caused by its having too much product to handle, results automatically in a decrease of cellular activity extending all the way from that of slight diminution to that of total cessation. The best comparison is to be found in the phenomena of fatigue and rest in muscle tissue. Fatigue in muscle is due to an accumulation of certain products of cell metabolism and the degree of fatigue corresponds to the extent of the accumulation and varies from slight grades of "feeling tired" to that excessive grade in which muscular activity gives out completely. Cessation of muscle activity furnishes an opportunity for the elimination of the excess of excrementitious materials and corresponds, clinically with the disappearance of the state of fatigue and the return of the state of rest. Fatigue in the liver cell is accompanied by a piling up of cholesterol in the blood stream. Opportunity for recuperation is provided by lessening the supply of lipid delivered to the liver cell which is accomplished by curtailment of fat in the

diet and by the rapid elimination of bile cholesterol by drainage.

This conception is illustrated in Chart 1 which shows the findings of an experiment carried out in a hypercholesterolaemic patient in whom a biliary fistula had been established for a therapeutic purpose. Originally a hypercholesterolaemic crisis had been present. On November 24 the cholesterol content of the blood and bile had fallen to normal levels under the influence (1) of bile drainage, and (2) of a diet in which minimal amounts of fat were allowed. Thereafter the diet was made to contain very large quantities of fat. Almost immediately the blood contained an increased amount of cholesterol but with the corresponding increase of the output of cholesterol in the bile the blood content of cholesterol showed a slight tendency to fall. On December 3 the output of cholesterol in the bile reached its highest point and thereafter it fell abruptly to a much lower figure in spite of the fact that the fat content of the food was continued for another 24 hours. This must be interpreted as indicating that at this point the liver cell reached the state of greatest fatigue and thereafter a diminution of its activity occurred. The sudden decrease in the output of cholesterol in the bile was followed by a marked retention of cholesterol in the blood which reached its maximum on December 9. Thereafter the blood content of cholesterol again fell to normal as recuperation was effected and the liver cell reached a state of normal activity.

It is quite possible that in persons with this established diathesis the threshold to fatigue in the liver cell is abnormally low. This may be due to factors similar to those previously described that is to toxins liberated in the liver cell environment. The one aids and abets the other and a vicious circle is thus formed. The place from which these toxins are most likely to originate is the intestinal tract. Such poisonous bodies may first of all be derived from the intestinal bacterial flora. Or the toxins may result from the normal digestive processes in which harmful by products are split off and sent to the liver via the portal system to be neutralized and excreted or otherwise dealt with.

Possibly this conception of fatigue as a cause for the accumulation and retention of cholesterol bodies in the blood furnishes an explanation for the frequently encountered temporary disturbance which passes commonly under the generic term of "biliousness." On purely empirical grounds this has been referred to the liver. Clinically this disturbance is most apt to be met in persons of the florid type who frequently eat a great deal more than they should and are fond of relatively rich foods. Some other associated facts include a thickly coated tongue a "bad" taste in the mouth, a sluggishness of the bowels with stools that are inclined to be scanty and of much lighter color than is customarily seen and a general lassitude and inaptitude of all of the body functions, both physical and mental. This corresponds fairly accurately with an insufficiency of liver function and the alternation of periods in which "biliousness" is or is not present corresponds, in my mind to alternating periods of fatigue and rest in the liver cell.

In a previous communication reference was made to hypercholesterolemic conditions which were observed to persist immediately after operation (cholecystectomy cholecystostomy either one with and without drainage) and which disappeared only when the bile passages were cleared of one or more stones at a secondary exploration. Other findings included (1) A sinus leading to one of the larger ducts, the hepatic or common duct. The outer end of the sinus was naturally infected. The presence of infection in the ducts proper could not be determined but from the character of the anatomical appearances of the interior of the duct, as demonstrated at the secondary exploration, it is correct to assume that no inflammatory reaction was present such as one ordinarily sees resulting from a bacterial infection. The absence of chills and fever and of other evidences of a sepsis indicated that there was no infectious cholangitis within the confines of the liver. (2) The escaping bile was usually of a greenish color was very turbid and deposited a heavy sediment on standing.

Inasmuch as preceding the secondary exploration the patient had been deprived of

any excess of cholesterol by the continuous discharge of bile from the fistula for a period of several weeks at least and by curtailing the sources of repletion in the food, it is correct to assume that the hypercholesterolemia was not due to any abnormally large amount of cholesterol held in the body economy but that some local factor was causing an interference with the metabolic mechanism where by a different distribution of what little cholesterol there was present was accomplished a proportionally larger amount of the latter accumulated in the blood as opposed to that retained in the solid tissues.

The prompt disappearance of the hypercholesterolemia after the clearing of the ducts of their contained stones indicates that the latter was the essential cause. The character of the facts here set forth shows that the stones played the part only of a mechanical irritant.

The notes of the following case illustrate the preceding facts. The case has already been published.

CASE No. 72. A woman had been operated upon for cholelithiasis and cholecystostomy as done. On September there was an attack of

TABLE III—LABORATORY FINDINGS IN CASE 72

	Temp Fahr	Blood cholesterol mg per cent	Bile cholesterol			Urine bile	Stool bile
			CLIN	mg gr	mg %		
Pre-operatin Sept. 6	99.8	55					
Post-operative Sept. 8	99		90	0.10	0.06	no	no
	99.4		140	0.10	0.37	no	no
	99.8		90	0.09	0.33	no	no
	3		130	0.10	0.35	no	no
	99				0.006	no	no
	99	6	170	0.08	0.3	no	no
	99		70		0.35	no	no
	98	4	490	0.10	0.3	no	no
	99		530		0.044	trace	no
	99.4						
Pre-operatin Oct	99	165				no	no
After and oper- ation Oct. 14	100			0.1	0.5	no	no
	99.8			0.30	0.005	no	sl col
	99.6			0.047		no	col
	99.4	5					sl col
	99.4						

colic. On September 26, the notes state that the discharge of bile was still profuse, the bile was green and very turbid and a stone was felt in the gall-bladder sinus which was promptly extracted. Up to October 12 however the drainage still continued to be just as profuse, and on the following day the bile passages were explored. A secondary cholecystectomy was done and a stone was removed from the papilla of Vater. The character of the drainage changed immediately and the color of the bile became clear golden yellow. The convalescence was uneventful thereafter. The laboratory facts are given in Table III.

In another communication reference was made to the disturbances of the cholesterol metabolism which occurred at later periods and sometime after operations for gall stones and gall-bladder disease were apparently successfully carried out. A number of reports (Elsendrath, Deaver, Judd and Harrington, Deaver and Reimann and Davis) were mentioned which fully describe the cases in which postoperative symptoms have been sufficient to require secondary operations, the actual cause being fistula, stone, cholangitis or obstructive jaundice. Such factors have only an indirect and contributory value in any accompanying disturbance of the cholesterol metabolism except in those stone cases in which it can be definitely proved that the calculi which are subsequently found in the ducts were formed since the primary operation.

The usual opinion that the stones which are found at secondary operations are the results possibly beyond the control of the operator of inefficiently done primary operations in which all of the stones are not removed is an assumption which seems to be entirely correct in the majority of the cases.

In such cases of postoperative common and hepatic duct stone, which we have studied there has always been present a hypercholesterolemia. Jaundice has usually but not always been present. There was no acute inflammation (infectious cholangitis) of the bile ducts present at the time of the secondary exploration. Naturally the secondary cholecystectomy was followed by a profuse discharge of bile. The escaping bile was clear or at most, contained shreds of inspissated mucus and the latter, when present, disappeared completely in the first few hours of drainage. Following the secondary operation in which

the ducts were explored and the stones removed there was a very prompt disappearance of the hypercholesterolemia.

In the presence of a discharging biliary sinus and in the absence of any jaundice the mechanism is similar to that described in the preceding paragraphs. In the presence of jaundice a relative obstruction is present especially in the capillary bile ducts which is due to swelling of the lining cells.

Duct stones in the presence of a healed wound and in the absence of jaundice have also been observed with hypercholesterolemia. The stone acts as a foreign body and causes an interference with liver cell activity leading to a diminution of function. In some of the cases undoubtedly there is also primary metabolic disturbances along the lines previously indicated. Except when definite knowledge is had from previous observation and study of the behavior of the cholesterol metabolism a final judgment is frequently not possible until some time has elapsed after operation and the postoperative course has been adequately observed.

If with a healed wound and a stone in the large ducts, an attack of colic supervenes, an obstruction forms more or less temporarily at the point where the stone becomes impacted. Back pressure is exercised upon the duct system and upon the liver cells which interferes with cell activity. In such cases one must give sufficient opportunity for the obstruction to be completely and sufficiently relieved by operation and by thorough clearing of the ducts before one can make any judgment as to whether the hypercholesterolemia is due in whole or in part to the obstruction.

Somewhat analogous facts are to be found with stones and obstructions in the urinary tract. A stone in any portion of the ureter or pelvis causes an interference with the functional activity of the kidney as shown by the various dye tests. Obstructions at the urinary outlet, the prostatic urethra also cause diminution of kidney function. In these respects the analogy between liver and kidney function is very strong.

It is conceded by nearly everyone that stones do occasionally form and reform in the ducts after cholecystectomy. And cases are



well known if rather uncommon in which intrahepatic stones are formed high up in the confines of the liver from which they are being discharged continuously. As a part of this clinical picture a chronic cholangitis is presupposed.

In the cases which we have studied, a moderate or well marked cholangitis of this type accompanied with intrahepatic stone precipitation has been rare. In one of the cases the cholangitis was associated with a continuous but variable grade of jaundice in the absence of any demonstrable hypercholesterolemia. The stones which were passed from the biliary (common duct) fistula were very small. They were, for the most part mere granules of a dark greenish black color and contained very little, if any cholesterol. In another patient, an intrahepatic precipitation of stones occurred and became continuous a hypercholesterolemia was present the stones, however were composed mostly of biliary pigments and to a less extent of cholesterol. In both of these cases the biliary fistula showed little tendency to close the amount of biliary discharge was usually of moderate amount although there were times when for a number of days it became of larger quantity. It was possible to cultivate bacteria from the biliary discharge. Bile was present in the stools in diminished quantity except at rather rare intervals then apparently some obstruction took place at the terminal part of the duct system and the stools become clay colored.

It is known that as time goes on a certain amount of connective tissue change is bound to take place around the intrahepatic bile passages and a form of biliary cirrhosis results. The occurrence of the latter probably has some influence upon the cholesterol metabolism.

Up to the present time the experience with cases of true cholangitis with and without intrahepatic stone precipitation has been extremely small and the subsequent discussion is therefore given with a certain amount of

reservation a final opinion is not possible at the present writing. However previous studies have shown that the jaundice accompanying cirrhotic liver changes is unaccompanied by any increase in the cholesterol content of the blood. This finding is a constant one. This observation furnishes a satisfactory explanation of the discrepancy in the cholesterol contents of the blood of the two cases described in the preceding paragraph. In the first a biliary cirrhosis was probably present in the second it probably was not.

The occurrence of a hypercholesterolemia with intrahepatic stones of cholangitic origin seems to depend on a number of phenomena. It is usually noted that the total amount of bile secreted by the liver is not up to the normal. This is probably due (1) to the swelling of the walls of the bile passages with a consequent narrowing tending to impede the outflow and (2) to the swelling of the liver cells themselves accompanying the marked congestion of the liver parenchyma. The views of Stadelmann and Eppinger Jr. which were referred to previously are especially applicable namely that toxic substances are liberated in the liver cell environment which cause specific changes in the liver cell environment and which lead to a decreased production or at least to a lack of proper discharge of bile into the capillary bile passages and to a consequent retention of bile components in the blood stream. In any case it seems reasonable to assume at present, that the underlying factor is a chronic infection of the intrahepatic bile passages, that the concretions have an infectious origin that any hypercholesterolemia, which is demonstrable is due to duct obstruction and interference with liver cell activity and the consequent retention of cholesterol bodies in the blood stream and that there is no underlying derangement of the cholesterol metabolism leading to an increased production of lipid bodies except as they form consequences of the toxic processes causing an interference with cellular activity.

ADHESIONS ABOUT THE ASCENDING COLON SIMULATING CHRONIC APPENDICITIS<sup>1</sup>

BY CHARLES DAVISON, A.M., M.D., F.A.C.S., MARSHALL DAVISON, B.S., M.D.  
AND DON J. ROYER, M.D., CHICAGO

**W**ITHIN the past 2 years our attention has been drawn to a group of cases which seem to present a new and definite surgical entity. They are of particular interest because of the ease with which the condition may pass unrecognized with a consequential non-relief of the subjective symptoms of the patient and a reflection on the ability of the surgeon.

The interest in this group of cases was initiated by our observation of a number of patients who presented a recurrence or non-relief of symptoms following operation for acute or chronic appendicitis. Closer observation of cases giving symptoms of chronic appendicitis in combination with roentgenographic examination has led us to the conclusion that the condition is not a rarity but is of a comparatively frequent occurrence.

The symptoms are those of a vague abdominal condition and are alike in those that have been operated upon for appendicitis with no relief, and in those who present themselves with no history of previous surgical treatment. In some instances the patients have been treated medically for a chronic gastro-intestinal disorder such as peptic ulcer colitis, chronic constipation or gall-tract disease. The relief under such management has been either temporary or absent, with a more or less rapid return of symptoms after a period of improvement.

The disassociation of such a syndrome with any definite condition led us to resort to complete gastro-intestinal examinations by means of the barium meal and X-ray in an effort to make a definite diagnosis, and it was by this means that the condition was first brought out. Such examinations revealed a definite and more or less pathognomonic disfigurement of the shadow contour of the ascending and transverse colon, which seemed to be caused by bands of adhesions passing over the ascending colon, involving to various degrees the

transverse colon and producing a partial or complete obstruction of the large bowel at the point of greatest involvement. In most instances the roentgenogram revealed a ptosis of the transverse colon, an agglutination of it to the ascending bowel, with a consequent kinking or constriction at the hepatic flexure. These roentgenographic findings are definite and laparotomy reveals the mechanical condition exactly as it is shown by the plates and fluoroscope. So absolute are these findings that we are able to diagnose definitely before abdominal section the exact position and extent of the pathology. With operative interference and a mechanical correction of the pathology present, the subjective symptoms are quickly relieved, and to date we have had no recurrence reported.

A brief résumé of a few typical cases with reference to the roentgenograms, will aid materially in the interpretation of a more detailed discussion. In each instance only a short outline of the case is given.

**CASE 1.** B. W. male, Jewish, age 36, clothier married. For the past 3 weeks the patient has complained of a dull, aching pain extending from the right kidney region downward into the lower right quadrant of the abdomen. It has not been sharp or cramping at any time, but has been severe enough to cause nausea. He has been troubled with digestive disturbances of an indefinite nature for several years. He is chronically constipated, and at times is bothered a great deal by gas. The patient states that his appendix was removed 17 years ago.

**Physical Findings.** A generalized abdominal distention of moderate degree is present. There is marked tenderness and rigidity over the entire right half of the abdomen. No definite palpable mass is present, but there is a feeling of different resistance to this portion. Leucocyte count 16,000. Urinalysis negative.

**Röntgenographic Findings.** (Fig. 1.) Examination by barium meal. The stomach and small bowel showed no pathology. At the twenty-four hour observation, there was evidence of constrictions at the junction of the cecum and ascending colon, and the transverse colon was adherent to the ascending portion. This remained the same at the forty-eight

hour observation despite catharsis and numerous enemata such were given with the intention of freeing the bowel of the opaque media, so that the right kidney might be visualized.

**Operative findings.** A high right rectus incision was made. The cecum and ascending colon were markedly distended with gas and fluid, and somewhat discolored. The old appendectomy scar was covered with omentum. At the upper portion of the ascending colon there crossed a thick, fibrous band of adhesions, fastening themselves to the transverse colon just beyond the hepatic flexure and producing a sharp angulation at that point. There was not a marked degree of ptosis of the transverse colon, and with the exception of the point of attachment of the band, there was no agglutination of the portions of the colon. The band of adhesions as dissected off a small portion of the denuded gut peritonized and the abdomen closed.

**CASE 2.** N. P. male Italian, age 56 laborer married. The patient has been bothered with constipation for years, which has been steadily growing worse the past 6 months, until now the bowels will hardly move even with the use of cathartics. At times he notices a tumor mass in the right lower quadrant of the abdomen. This mass is about the size of a man's fist, slightly tender seems to move about the abdomen, and disappears after defecation. There is severe cramping pain in the abdomen during the attacks of constipation, which is relieved by defecation and the expulsion of gas. There is left, however, dull, constant pain, which remains until the next attack. He is nauseated at times, but has never vomited. Appendix removed 4 years ago.

**Physical findings.** There is no noticeable difference in the contour of the abdomen. A moderate degree of tenderness and rigidity is present over the ascending colon and hepatic flexure, with slight tenderness and rigidity over the entire abdomen. There are no tumor masses palpable. Leucocyte count 6,800. Urinalysis is negative.

**Röntgenographic findings.** Examination by barium meal. The stomach and small bowel showed no evidence of pathology. At the twenty-four hour observation the ascending and transverse colons were found to be adherent, and there were apparent constrictions at the hepatic flexure and the middle third of the transverse colon (Fig. 1).

**Operative findings.** A right rectus incision was made in the upper quadrant. The cecum was drawn up and inspected, and found to be dilated but freely movable. The transverse colon was ptosed, rotated anteriorly and bound to the ascending colon about 6 centimeters below the hepatic flexure by a band of the same width arising from the lateral peritoneal wall. The adhesions are freed, and the gut peritonized.

**CASE 3.** S. F. male Italian, age 55, retired, married. For the past 6 months the patient has had pain in the entire right abdomen and stomach. The pain extends from the ribs downward, is acute in type with nausea and vomiting, and seems to be

slightly relieved by bowel movements. The patient has had stomach trouble for years, which he thinks has been due to constipation. His appendix is removed 5 years ago.

**Physical findings.** There is tenderness over the entire right side of the abdomen, most marked at the upper quadrant. Slight rigidity is present, but no palpable masses. Leucocyte count 10,000. The urinalysis is negative.

**Röntgenographic findings.** Examination by barium meal. The stomach showed delayed emptying time. There is evidence of a pathological gall bladder with periducodenal adhesions. At the twenty-four hour observation, the cecum was found to be bound down in the lower right quadrant, and the ascending and transverse colons were adherent. This condition remained constant over a period of seventy-two hours, after which the examination was discontinued (Fig. 3).

**Operative findings.** An incision as made over the right rectus muscle in the upper quadrant. Adhesions were found binding the transverse colon to the liver and surrounding the gall bladder. The pylorus was also bound to the under surface of the liver. The ascending colon and cecum were bound down by bands of adhesions arising from the lateral parietal wall. The gall bladder was markedly thickened, and slightly enlarged. The adhesions about the gall bladder, pylorus, and liver were broken up. The cecum and ascending colon are freed and peritonized, and the gall bladder was drained.

The patient died on the third day from a paralytic ileus.

**CASE 4.** P. B. female, American, age 30, stenographer single. The symptoms began a short time after an appendectomy 3 years ago. The patient complains of pain in the back radiating to the right lower quadrant of the abdomen. This has been noticeable for the past year but has become more in the last 4 months. At times the pain radiates to the right hip and leg. It is of a dull, constant, aching character, with no acute attacks. Headaches are frequent. Nausea, but no vomiting, is present for 3 or 4 days before menstruation. Appetite is poor. The patient is always constipated.

**Physical findings.** There is tenderness at point of old right rectus scar extending upward to the gall bladder region. There is no tenderness in the back. Leucocyte count 9,600. Urine is negative.

**Röntgenographic findings.** Examination by means of barium meal. The colon was infiltrated and appeared normal to about the middle third of the transverse portion, where there was an apparent constriction. There is difficulty in getting the barium through the hepatic flexure and into the cecum. The cecum was bound down below the crest level, and the ascending and transverse colons were adherent to each other (Fig. 4).

**Operative findings.** An incision was made at the region of the old scar. The omentum was adherent to the anterior parietal peritoneum at this point. There was an adhesion band about 4 inches in width

extending from the parietal peritoneum over the cecum and ascending colon up to the proximal third of the transverse colon. There was ptosis and anterior rotation of the transverse colon, with angulation at the hepatic flexure. The cecum and ascending bowel were markedly dilated. The adhesions were broken up, the colon freed, and peritonized.

**CASE 5** J. G. male, American, age 60, banker married. The symptoms have been present for an indefinite time. A dull pain is present in the right side which steadily has been growing more noticeable for the past year. The pain never was severe until 3 months ago, when it became more intermittent and of a cramp-like nature. The patient has had indefinite digestive disturbances with frequent eructations of gas after eating. He never has a bowel movement without the use of a mild laxative. A short time ago he was given the diagnosis of chronic appendicitis by his physician.

**Physical findings.** The contour of the abdomen is normal. There is slight tenderness and rigidity over the region of the appendix, which extends to the upper quadrant of the abdomen. Leucocyte count 14,000. The urinalysis is negative.

**Röntgenographic findings.** Examination by means of a barium meal. The stomach and small bowel showed no evidence of pathology. At the twenty-four hour period there was evidence of a pathological retrocecal appendix, and there was definite evidence of circular adhesion constricting the large bowel at the junction of the cecum and ascending colon (Fig. 5).

**Operative findings.** A right rectus incision was made. A partially obliterated appendix was found lying retrocecaly bound against the cecum by a mass of adhesions. The appendix was dissected out and amputated. The adhesions also bound the ascending colon to the proximal portion of the transverse colon, producing a constriction of the lower portion of the ascending bowel. There was no obstruction at the hepatic flexure. The gall bladder and duodenum were negative.

**CASE 6** B. E. female Jewish, age 30, stenographer single. Indefinite gastric distress and vomiting have been present for the past 6 months. There have been no acute attacks, but the patient has been bothered by dull pain and discomfort over the entire right side of the abdomen. Vomiting occurs at infrequent intervals, and seemingly has no relation to the pain. The patient is habitually constipated. Dull headaches are present every few days. There has been a slight loss in weight.

**Physical findings.** There is marked rigidity and tenderness over the entire right side of the abdomen, especially marked over the region of the appendix. White count 11,000. Urinalysis negative.

**Röntgenographic findings.** Examination by means of a barium meal. The stomach showed no evidence of pathology. There was a reflex constriction in the duodenum causing a gastric stasis. At the twenty-four hour observation there was evidence of a pathological retrocecal appendix with paracetal

adhesions. The ascending and transverse colons were adherent, and there was evidence of spastic colitis (Fig. 6).

**Operative findings.** A high right rectus incision was made. A long infected appendix, not involved in any adhesions, was removed. The gall bladder, tubes, and ovaries were normal. A small band of adhesions arising from the lateral parietal wall extended over the ascending colon, producing a slight constriction, and binding down the region of the transverse colon just distal to the hepatic flexure, producing a moderate degree of kinking at that angle. The band of adhesions was cut and the bowel liberated and peritonized.

**CASE 7** A. G. female American, age 47, housewife, widow. The symptoms have been present for 3 years. The patient complains of pain in the right side of the abdomen radiating to the back. This pain is described as being of a pulling dragging nature, and worse after doing heavy work. It is not influenced by the taking of food. When the pain is severe it is accompanied by nausea, but the patient does not vomit. She has been habitually constipated for years.

**Physical findings.** There is marked tenderness and rigidity over the entire right side of the abdomen, with exquisite pain in the right lower quadrant. There is slight abdominal distention, and a gurgling sound may be heard on auscultation. There are no palpable masses. Leucocyte count 7,500. Urinalysis is negative.

**Röntgenographic findings.** A barium meal was given. There was evidence of an old duodenal ulcer. At the twenty-four hour observation the appendix was not noted. There were adhesions between the ascending and transverse colon, along the entire length of the former (Fig. 7). This condition was still present at the forty-eight hour observation.

**Operative findings.** On abdominal section the transverse colon was found bound to the entire extent of the ascending colon by a broad band of fibrous adhesions covering over both portions of bowel. This was freed and the two portions of bowel liberated and separated. The gall bladder was atrophied to the size of a hazel nut, and contained no stones. A Riedel's lobe of the liver was present. A long fibrous appendix, lying retrocecaly with no adhesions, was removed.

**CASE 8** G. W. male, American, age 44, foreman, married. The symptoms have been present for 10 years. He complains of pain at irregular intervals which is of a dull, constant nature, located in the epigastrium, right hypochondrium and right lower quadrant. The patient has had three attacks of an acute abdominal crisis which passed off in a few hours. Constipation is always present and the pain is worse when this is the most marked. He also is troubled with eructations of gas after eating. He is sometimes nauseated, but has never vomited except during an acute attack. His appetite is poor.

**Physical findings.** There is marked tenderness and rigidity over the right side of the abdomen from

the hypochondriac to iliac regions. Tenderness in epigastrium is present, but not marked. There is moderate amount of abdominal distention, and the abdomen is tympanic with the exception of the right lower quadrant, where resonance is impaired. White count 6,400. The urine showed no findings.

**Röntgenographic findings:** A barium meal was given. There is definite evidence of a duodenal ulcer. (This perforated the evening of the first day of the examination.) At the twenty-four hour period the cecum was found to be down below the crest level. The ascending colon and transverse colon were firmly adherent (Fig. 8). This condition was still present at the forty-eight hour period. The patient returned for operation 5 days later and fluoroscopy at that time showed practically the same condition to be present.

**Operative findings:** (Case operated by Dr. Karl Meyer.) On opening the abdomen a perforated gastric ulcer was found. There was a plastic exudate between the stomach, liver and intestines, with free fluid present. The perforation was closed and peritonized. A dense band of adhesions about 6 centimeters in width covered the ascending colon, and attached itself to the transverse colon just beyond the hepatic flexure, bringing the two portions of bowel into apposition. This band was cut and dissected from the bowel wall but peritonization of the denuded portions was impossible. A long retrocecal appendix was found bound in adhesions which were distinct from those composing the band found at the hepatic flexure. Appendectomy was performed, and the abdomen closed without drainage.

**Case 9:** J. K. male, Lithuanian, age 43, machinist, married. Duration of symptoms given as one year. The patient complains of gaseous eructations, constipation, and abdominal pain. The pain is located in the right hypochondrium and epigastrium, and is worse after eating. It is dull and aching in character, never acute, and sometimes radiates to the back. The patient is at times nauseated, but never vomits. He has been treated medically for duodenal ulcer, with no relief.

**Physical findings:** The abdomen is scaphoid in contour. There is slight tenderness over both upper and lower quadrants of right side of abdomen but no rigidity is present. Otherwise the findings are negative. Leucocyte count 9,000. The urinalysis is negative.

**Röntgenographic findings:** Examination of the stomach by means of barium meal revealed no pathology. The duodenum showed evidence of an ulcer. At the twenty-four hour observation the appendix appeared retrocecal and pathological. There were definite adhesions between the ascending and transverse colons (Fig. 9).

**Operative findings:** A high right rectus incision was made. The ascending colon was found bound to the transverse colon at the region of the hepatic flexure by a band 4 centimeters wide, arising from the lateral peritoneal wall. The ascending colon was dilated and filled with fecal matter. A chronic retro-

cecal appendix also was found, but with no adhesions about it. The adhesive band was cut, the bowel peritonized, and the appendix removed.

**Case 10:** M. R. male, Jewish, age 35, salesman, married. The following symptoms have been present for 3 years. Pain in the right side radiating from the lower quadrant upward to the costal arch. A feeling of discomfort in the abdomen is always present with periods of indigestion at long intervals. The patient vomits occasionally. He has had three acute attacks within the past 3 years which are diagnosed as being either appendicitis or cholecystitis. The patient is habitually constipated.

**Physical findings:** There is tenderness in the right side of the abdomen from the lower to upper quadrants, with some accompanying rigidity. There are no palpable masses. No distention is present. Tenderness over the gall bladder area is no more marked than in other regions of the right half of the abdomen. Leucocyte count 15,400. The urinalysis is negative.

Röntgenograms of this case were not made.

**Operative findings:** There are bands across the colon from the lateral parietal peritoneum to the proximal third of the transverse colon. This is drawn down against the ascending bowel, and marked angle was thus made at the hepatic flexure. The gall bladder and region of the duodenum are negative for pathology. A chronic obliterated appendix was found and removed. It was free from any adhesions whatever. The adhesions which were cut, and the two portions of the bowel separated. Only slight peritonization was necessary.

To us the etiology of this condition still is somewhat vague and not definitely determined. That it is not a congenital condition is proven by the facts that it is not evident at birth, that it is more frequent later in life and that it seems to be a progressive affair. An analysis of the age of the patients affected leads only to the conclusion that its occurrence is at the time when all chronic abdominal conditions are most frequent, i.e. from middle adult life upward. Sex would seem to have no influence, as in this series the occurrence is about evenly divided. It is of interest to note however that all of the patients have led sedentary lives, and all give a history of chronic constipation. This probably is the most important single factor in the entire etiological chain.

With such an assumption we naturally turn to the theory of infection. Chronic constipation is but another term for intestinal stasis, and such stasis necessarily must be at its greatest degree in the large bowel. As a reac-

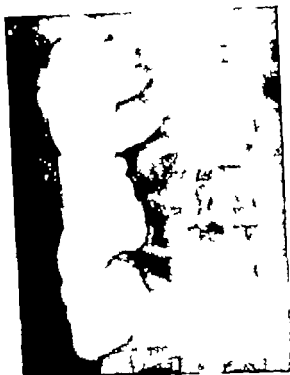


Fig. Case. Roentgenogram 48 hours after barium meal showing practically complete obstruction at hepatic flexure. The ascending and transverse colons are bound together by adhesive bands at the hepatic flexure. Gas is seen in the propped transverse colon.



Fig. Case. Roentgenogram 36 hours after barium meal. Show agglutination between ascending and transverse colons by circular bands at hepatic flexure extending over to middle third of transverse colon, and producing marked ptosis.

tion to the constant accumulation of feces and resulting atony of the bowel, there naturally results a lowered resistance of the gut wall and an opportunity for the migration of bacteria through to the peritoneal surface and a consequent inflammation. That the infection must be low grade is obvious, otherwise it would result in a more diffuse and acute form of peritonitis. The adhesions which would result from such an inflammatory change seem to occur locally at the point of greatest stasis, i.e. at the ascending colon. We know that for this reason the dependent location of the appendix makes it a constant cess pool of infection and that when its ability to empty is lost, then occurs an acute or chronic appendicitis depending upon the virility of the organisms.

There is no doubt but that a chronic appendicitis is often found accompanying the condition. However the appendix is not always implicated in the adhesive bands, and very

often is free while a higher portion of the gut will show the distinct pathology. In this regard four of the series of cases have had an appendectomy performed at intervals from 2 to 17 years before coming under observation for a new condition. This may mean one of two things either the condition was present at the time of operation and escaped notice or had its inception and progression at a later date. In the first instance removal of the appendix evidently had no effect on the growth of the adhesions or we would have had a cessation of symptoms instead of a condition growing progressively more marked. The second instance again would seem to prove that the presence of the appendix would not necessarily be a determining factor in the production of such regional adhesions. A chronic appendicitis likely has the same etiology as has the production of these bands, but it is an accompanying condition, and not a cause.

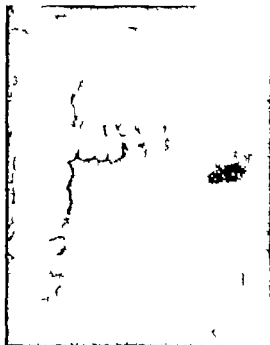


Fig. 3. Case 3. Observation at 48 hours showing complete fixation of proximal portion of transverse colon to area of ascending colon at hepatic flexure by band extending across upper portion of ascending colon. Notice the marked sparsity of the free portion of the transverse colon, which is found in practically all cases.

The fact that these bands seem to have a tendency to involve the colon at the region of the hepatic flexure naturally would lead us to look for such inflammatory pathology in that region as a chronic gall-tract disease or a duodenal or pyloric ulcer. In only one case (Case 3) was any pathology found in the upper right quadrant which might have been an exciting cause, and in this instance the adhesions about the gall bladder were distinct, separated, and of an entirely different type from those that came upward from the ascending colon.

Ptois of the transverse colon would be a very important determining factor. It will be noticed that in practically every case this condition has been found to be present, but it is no doubt more marked after the transverse colon has been dragged farther downward by the influence and retraction of the bands. If it existed early only to a slight degree however it would mean a definite angulation at



Fig. 4. Case 4. Roentgenogram after barium meals under compression, showing marked ptois of transverse colon with traction angulation at the hepatic flexure, and angulation of transverse to upper portion of ascending colon. The obstruction is incomplete. Outline of gas shows distention of ascending colon.

the hepatic flexure with a consequent slowing of the fecal current over that portion and a resultant stasis in the ascending colon of a more marked degree.

So it seems to us that the determining factor in the production of this condition is the stasis in the ascending colon, with the resultant possibility of band formation at the point of lowest resistance of the bowel wall.

Pathologically the condition seems to occur in two forms. In the first, and most frequent (Fig. 10) the band seems to arise from the junction of ascending colon and lateral parietal peritoneum, spreads in a rather fan-shaped manner over the ascending colon, upward and onto the transverse colon, attaching to it at a short distance from the hepatic flexure. Evidently by contraction of the band the transverse colon is rotated anteriorly and further ptoed, bringing it into a variable degree of apposition with the ascending bowel, and thus producing a marked angulation at the hepatic flexure, and a partial obstruction.

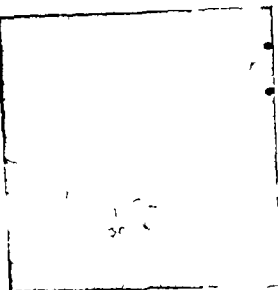


Fig. 5. Case 5. Observation after 30 hours, showing partial obstruction at hepatic flexure, slight ptosis of transverse colon, and its approximation to the ascending colon by traction.

The second type (Fig. 11) may be but an earlier degree of the condition just described. In this type, the band does not reach across to the transverse colon but rather seems only to involve the ascending portion. Evidently there occurs a thickening or contraction of the band which diminishes to a variable degree the lumen of the colon, with again a chronic obstruction. In either case they seem to arise at points varying from the mid portion of the cecum to a position about two-thirds the height of the ascending colon. In no case were they limited to an involvement of the cecum, but appear to have a tendency to originate slightly higher and to spread upward figuratively as if reaching for a portion of the transverse colon. In width we have seen them vary from 2 centimeters to a size sufficient to cover practically the entire upper two-thirds of the ascending colon and the proximal half of a ptosed transverse bowel, making the two portions of the colon appear at first glance as if one.

But these differences are matters of location, extent, and mechanical effects. In gross histological appearance the bands are identically the same. They are of the dull, glistening, white color of fibrous tissue, varying in thick-



Fig. 6. Case 6. Showing partial obstruction of barium at 24 hours. Transverse colon is acutely angulated to lie anteriorly to ascending portion by traction of band in region of hepatic flexure. Gas is seen in ascending colon.

ness, but always too dense to be called a membrane. They are highly vascularized with many small vessels which seem to arise and spread out from the point of origin of the bands. In some instances the bowel wall may



Fig. 7. Case 7. Taken 24 hours after barium meal, showing transverse colon markedly ptosed and bound to entire length of ascending colon. Under the fluoroscope, it was not possible to separate the two portions of the bowel.





Fig. 8. Case 8. Thirty hour bismuth observation showing transverse colon bound to ascending colon by adhesive band, producing obstruction at hepatic flexure. This roentgenogram as practically unchanged five days later.



Fig. 9. Case 9. Observation at 24 hours showing fixation of transverse colon to upper half of ascending colon by band passing over the ascending colon. Notice the acute angulation at the hepatic flexure.

be localized through this overlying structure, but in others the density is too great. The surface has almost the smooth glisten of normal peritoneum but close inspection will reveal a definite limitation of the new tissue and its difference from the true peritoneal appearance.

Although on dissection there is a definite plane of demarcation between the peritoneal coat of the bowel and the under surface of the band the agglutination between the two surfaces is so close that it is impossible to separate the two without deperitonizing the gut wall. Removal of the adhesive bands leaves a raw, bleeding surface, and has the same effect on the under surface of the removed tissue. Because of the close agglutination between the two a sliding motion of the bowel in its peristaltic movements beneath the band is not possible and any manipulation of the intestine means a movement of the entire mass to the limits of attachment of the adhesion. This condition is definitely not analogous to the membrane described by Jackson. It is not a membrane but a definite band. It is not limited to the cecum and in fact does not seem to involve it to any great degree. Furthermore it is closely attached to the perito-

neal coat of the bowel from which it is impossible to be separated. Jackson's membrane is a veil-like growth, thin, transparent and vascular which spreads over the cecum. It is not attached to the covering of the bowel, movements between the two are possible, and careful removal of the veil does not injure the peritoneum of the gut wall.

As has been said earlier a pathological appendix is often found with the condition. But that the two go together as accompanying pathological entities, both results of the same cause and one not of the other seems to be proven by the fact that when a chronically inflamed appendix is found, even in the presence of adhesions, the two conditions seem always to be definitely separated and to have different grades of pathology. Again there is that group of cases in which there are no adhesions about either appendix or cecum, and finally the group associated with a normal appearing cecum and appendiceal scar.

The symptoms of this condition simulate



Fig. Anatomical diagram illustrating one phase of the pathology. The band has its origin at junction of colon and lateral parietal peritoneum, passes over the ascending colon and is attached to the transverse portion. There results traction (Pto-s) and anterior rotation of the transverse colon, and fixation of it; the approximated ascending bowel.



Fig. Diagram illustrating different type of same pathology. In this the band does not reach to affect the transverse colon, but has its entire constricting influence on the ascending portion. Notice slight degree of ptosis of the transverse colon.

the ordinary syndromes of chronic abdominal conditions especially that of chronic appendicitis. The chief complaint has been of a vague abdominal pain, in most cases located in the right side of the abdomen but not definitely limited to the region of the right lower quadrant, as it generally is in a definite chronic appendix. The area of pain has a tendency to spread upward to involve the region of the right hypochondrium, and often radiates to the back. There is also an indefinite history of digestive disturbances such as a feeling of heaviness after eating, anorexia, gaseous eructations, nausea and occasional vomiting. Constipation is the rule and is generally so chronic that it is put in a minor quantity by the patient. Acute abdominal crises arise in this condition in instances in which there occur a complete or almost complete mechanical intestinal obstruction and

in those instances the symptoms are classical.

The physical findings are slightly more definite than are the symptoms. The abdominal tenderness and rigidity are somewhat more diffuse than we find them in cases of chronic appendicitis, and extend higher toward the costal arch without involving however the painful area generally found in gall-bladder disease. There is no one exquisite point of tenderness but it is diffuse over the entire region of the ascending colon to the hepatic flexure.

The leucocyte average in our series of cases was 10,000 with a minimum count of 6,200 and a maximum of 15,400. The variation may be explained on the basis of differing individual reactions to infection, amount of intestinal obstruction and consequent toxic absorption, and the condition of the appendix when present.

It may be seen from the above discussion that such a train of symptoms simulating a chronic appendicitis would be of value only in those cases in which the appendix previously had been removed and in such instances they prove to be definite of the condition described. In any instance they may simulate any one of several chronic abdominal conditions and in order to arrive at a definite differential diagnosis we resort to the use of roentgenographic examinations. By this means we are able not only to rule out the presence or absence of other condition along the gastro-intestinal tract, but we are able to remove any doubt as to the suspected condition. Too much dependence on symptoms and physical findings often will lead to an incorrect or incomplete diagnosis. We do not believe dogmatically in diagnoses which have for their basis laboratory findings with too little regard for symptoms and physical examinations. But here we have a condition which can be absolutely and definitely diagnosed by the roentgenographic findings and a complete diagnosis is possible in no other way.

In the roentgenographic examination of these patients we prefer the barium meal. The clyster rarely fails to locate the pathology but has for its disadvantage the fact that we may fail to discover pathology higher up in the gastro-intestinal tract. The cases are examined by both plate and fluoroscope at frequent intervals immediately after ingestion of the meal and then at successive intervals of 6, 8 and 12 hours. The observations taken at 24, 36, 48 and if necessary 72 hours are the most important in locating the colonic pathology for by that time we are able to visualize relative changes in the contour of the large bowel and the final progress of the barium into the rectal pouch. By such examination we are absolutely able to locate the position of the band, the degree of ptosis of the transverse colon, its relative position to the ascending colon (Figs. 10 and 11) and the degree and location of the bowel obstruction. With such findings our diagnosis is complete.

The treatment of course is the surgical relief of a mechanical condition. An incision is made that will best expose the entire pathology and depends upon its extent. By care-

ful dissection the adhesive bands are freed. It is rarely necessary to resect any portion of the tissue because there is an immediate contraction as soon as it is liberated. Due to the fact that there is such a close agglutination between the adhesive bands and the peritoneal covering of the gut it is impossible to separate the two without injuring the peritoneal coat. All such raw surfaces must be peritonized otherwise a reformation of adhesions will occur practically the same mechanical condition will be present and the patient will experience little if any relief.

The postoperative treatment of these cases also is of prime importance in preventing the reformation of adhesions. For several days following operation, they are kept on their left side as constantly as is possible. This has the mechanical effect of allowing the newly freed transverse colon to drop away from its former position beside the ascending portion. After time enough has elapsed for the bowel to become again peritonized this is not necessary. As a further effort to prevent new adhesions, active movement of the bowel is kept up by the frequent administration of cathartics, preferably magnesium sulphate. This has the disadvantage of increasing gas accumulation within the bowel but the slight bowel distention which results from the gas is an added mechanical advantage against any new adhesions. However the patients must be watched closely for too great a distention is a forerunner of a paralytic ileus.

#### SUMMARY

1. The condition seems to be a definite surgical entity.
2. Its symptoms simulate those of chronic appendicitis but often occur after appendectomy.
3. Chronic appendicitis is sometimes an accompanying condition but is not the causative factor.
4. Evidently it is an inflammatory lesion due to colonic stasis.
5. An absolute diagnosis may be made by means of roentgenographic examinations, and in no other manner.
6. The treatment is the surgical relief of a definite mechanical condition.

## PLACENTA ACCRETA ITS INCIDENCE PATHOLOGY AND MANAGEMENT

By JOHN OSBORN POLAK, M.D. F.A.C.S. and GEORGE W. PHELAN, M.D. BROOKLYN

AT the meeting at White Sulphur Springs I presented to this society a preliminary report on the management of the third stage of labor which was based upon a study of 2,000 deliveries. In this paper I made some suggestions as to the management of the retained and adherent placenta and recommended that in placenta accreta hysterotomy followed by hysterectomy should be the procedure of choice. The suggestion however must have fallen upon deaf ears, for it was not even mentioned in the discussion.

Recent studies of the mortality incident to true adherent placenta, both here and abroad, by obstetric methods heretofore in vogue show that placenta accreta is attended by a high death toll. True placenta accreta is extremely rare but four such cases have been encountered by the writer in 30 years of obstetric practice yet during 20 years it has been my fortune to be at the head of three active services. These cases present a definite anatomical and clinical picture which if it were thoroughly understood would considerably reduce the mortality.

It is the purpose of this short contribution to show first, that, though rare placenta accreta is a pathological entity and should not be confounded with adhesion of the placenta for an accreta is the result of an entire or almost entire absence of the decidua basalis which exposes the muscle of the uterine wall to the erosive action of the trophoblast and penetration of the villi. This intimate union of the placenta and muscle wall makes it impossible to find any line of cleavage for placental separation.

Second, that the etiology is dependent upon changes which produce an atrophy or absence of the normal uterine decidua such as previous manual removal of the placenta, vigorous curettage, endometritis, submucous myomata, etc.

Third, that the high mortality attending this complication is the direct result of im-

proper treatment from failure to recognize that in a true accreta there is no line of cleavage, for the placenta is not only an intimate part of the muscular wall but the erosive action has so thinned this wall that attempts at removal produce hemorrhages and open up avenues for infection and even permit perforation of the uterus.

Finally that true placenta accreta necessitates both rational and radical management with attention to every aseptic detail.

In order to establish the truth of these statements we have reviewed 6,000 deliveries occurring in the in- and out patient services of the Long Island College Hospital. These have been studied to determine (a) the frequency with which the complication is met (b) the incidence of infection (c) the method of treatment employed and, finally, the complications that have occurred including the mortality. The existence of abnormal adhesion has been assumed when the placenta has been retained within the uterus for more than two hours following the delivery of the child without the occurrence of uterine hemorrhage for clinically separation of the pla-



Fig. Retained placenta



FIG. 2. Case of adherent placenta. Central implantation.

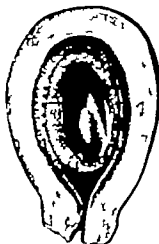


FIG. 3. Formation of placenta.

from side to side and intermittently relaxed, not assuming the firm contraction and ball-like shape characteristically present in the separated placenta.

If we revert for a moment to the consideration of the formation of the placenta we will remember that it is formed partly from the chorion frondosum and the decidua basalis, and that the villus processes of the chorion are in contact with the basal decidua, grow rapidly and penetrate by erosion into this decidua while those on the remaining portions of the ovum in contact with the uterine decidua atrophy.

centa does not occur without bleeding. It has been necessary to differentiate this condition from simple retention of a separated placenta due to the partial closure of the retraction ring.

In retention of the separated placenta three clinical signs are always evident: (1) uterine bleedings; (2) descent of the cord; (3) the characteristic ball-like condition of the fundus. Rise of the fundus is not found in either retention or adhesion.

Conversely it may be stated that in adherent placenta or placenta accreta provided there has been no manipulation to cause partial detachment there is neither hemorrhage, descent of the cord, or change in the position of the fundus, and the fundus assumes a characteristic shape being broader

Histologically the chorion frondosum consists of a connective-tissue layer which lies next to the amnion and a villous layer made up of villi which are covered by an outer layer of trophoblastic cells. As each villus grows into the basal decidua which protects the muscular structure of the uterus from invasion it makes for itself a space by erosion into the mucosa. This space is always larger than the villus which is growing into it and ultimately forms a spacious sinus or blood space which is filled with maternal blood. Into this sinus the villus projects and becomes bathed in the maternal blood but does not penetrate beyond the protective basal decidua. These are called the floating villi; others, however, opposite the funic insertion and near the

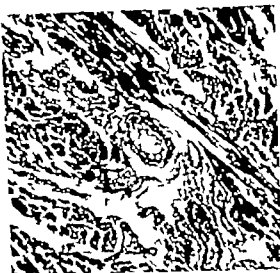


Fig. 4. Engorged blood vessels in serotina.



Fig. 5. High power of same field.

placental circumference become more deeply attached and extend further into the mucosa and fasten the placenta to the underlying structures. These are the anchoring villi. The protection of the muscular wall of the uterus from the diffuse erosion of these villi covered as they are with trophoblastic cells is due to the fact that normally there is interposed a protective layer of decidual reaction in the basalis or serotina. Certain conditions cause this protective layer of endometrium to be absent or atrophied. This permits the villi to erode themselves into the muscular wall of the uterus and even penetrate through the uterine muscle. This fetal cell invasion so weakens the uterine wall that perforation is easy; the placenta and myometrium become a continuous mass inseparable from one another. This absence of the decidua basalis and implantation of the placenta in the myometrium must not be confused with prolonged adhesion of the placenta due to muscular difficulties, as when implantation of the ovum occurs in the tubal corner where the decidua is often absent or poorly developed or when implantation has taken place on a uterine septum or when the placenta is large and thin as in certain instances of twins or hydramnios with a fundal attachment. In these cases the placenta does not become separated in the usual way yet we find that the histological

structures of the basalis can be demonstrated.

If we go a step further and review the mechanism of placental separation we can readily see how dependent we are upon the serotina for accomplishing this separation. Immediately on the delivery of the fetus, the entire uterus, except the placental site, retracts and thickens. This immediately produces an enlargement and engorgement of the vessels in the site within the spongy layer of the serotina. With the first contraction, the placental area is suddenly reduced and more vessels are torn by the folding or puckering of the placenta, and retroplacental bleeding takes place, which with the next contraction is compressed along the line of cleavage and the placenta separates off in the spongy layer of the serotina. With the absence of the serotina with its spongy layer which cannot be found in histological study of placenta accreta the villi penetrate the muscle walls of the uterus and hence the placenta and walls make up one continuous structure and present no line of cleavage.

In reviewing our records of both in and out patient services for the past 5 years we find that there have been eight manual removals of the placenta; three were partially or completely adherent, but a line of cleavage could be found and followed until separation was completed; four were separated but retained



Fig. 6 Showing separation of placenta by retroplacental blood accumulation

by a retraction ring while in one no line of cleavage could be found or demonstrated. Placental tissue was removed piecemeal the removal was incomplete and the hemorrhage was so excessive that further manipulation had to be postponed the uterus firmly packed and restoratives applied. A donor was sought but before transfusion could be done patient died 9 hours after admission. Autopsy was denied. It is fair therefore to place the incidence of accreta at approximately one in six thousand (1/6000).

In my private series the incidence has been greater but considering that only cases with complicated histories and in difficulties reach the obstetric consultant, the fact that three placental accretae have been met should not be considered exceptional. In two manual removal was unusually difficult and this piecemeal removal was attended with such severe hemorrhage as to cause me to desert and pack the uterus. Both died of sepsis. Both of these women were multiparae and had had previous manual removal which was also a fact in the fatal case reported by Dietrich and the successful one of Greiswald.

From a study of histories of reported cases available it is apparent that previous manual removal of an adherent placenta or repeated or vigorous curettage predisposed to adhesion in subsequent pregnancies.



Fig. 7 Case of placenta accreta. Implanted in uterine cornu, 1 on trophoblastic endometrium, over large myoma.

My third case is illustrative of an accreta occurring on an absent decidua a result of repeated curettage with an implantation on the atrophic endometrium of a submucous myoma.

This patient was 26 years old and married 5 years never pregnant. She had been subjected to four curettages, one for terbit and three for menorrhagia. There was no menstruation after her last curetting. When seen by the writer 15 months later she was in labor the uterine tumor as very large reaching the ensiform, and smooth hard tumor mass could be palpated just above the pubis in the left lower quadrant the labor was easy and dead born, 7 months fetus was delivered after about 5 hours of pain. Following the birth of the child the fundus remained about 10 centimeters above the umbilicus. The placenta was not expelled. There was no bleeding. The uterus contracted later untidly. Repeated efforts with Credé's method failed to express the placenta. She was removed to the hospital and 6 hours after delivery under ether narcosis and with the strictest asepsis the gloved hand was introduced into the uterus. In the lower segment on the left uterine wall just above the internal os a large submucous fibroid (the mass of grapefruit) spread out on its summit and attached to the entire left uterine wall. Above the tumor as



Fig. 8 Placenta accreta. Villi penetrating muscle

spread the placenta. No line of cleavage could be detected so we decided that as it was a clean case we could open the abdomen do hysterotomy, attempt detachment under sight, and, if we failed, remove the uterus. This was done after incising the uterus at the right edge of the placenta. An attempt at separation was made, but no line of cleavage could be detected. The uterine wall over the placenta was relaxed and thin. A supracervical hysterectomy was made and an uneventful recovery followed.

Gross study of the uterine wall showed that the uterine muscle had been replaced by placental tissue and at several points it had only a peritoneal covering. This was most apparent just opposite the insertion of the cord. Macroscopically there was an absence of the decidua; the villi were directly attached to the uterine muscle and in several fields syncytial cells were found in the fibers while masses of the same cells had split the muscle wall into fragments. Study of this specimen shows the futility of attempting manual removal in placenta accreta and emphasizes the importance of aseptic exploration before proceeding to traumatize these friable tissues.

Placenta accreta therefore may be described as the implantation of the ovum and the development of the placenta on a uterine wall in which there is a total or almost total absence of the decidua serotina. The chorionic



Fig. 9 Placenta accreta. Invasion of syncytial cells into the muscle wall

villi erode themselves into the muscle fibers hence the uterine muscle partly degenerates resulting in a thinning of the uterine wall over the placental site, even to the point of rupture.

An appreciation of this pathology shows why the mortality from hemorrhage, sepsis, and perforation, make this condition so formidable. Of our four cases, three died from hemorrhage or sepsis, one recovered. This with Greifswald's case are we believe the only two recoveries in the literature.

#### CONCLUSIONS

1. In our series the incidence of placenta accreta is about 1 in 6000 cases.
2. There is considerable confusion in the minds of the profession between simple adhesion of the placenta and true accreta.
3. Accreta is a definite pathological entity.
4. Manual removal is impossible and can only result in hemorrhage, sepsis, or perforation.
5. Every delayed placenta with no hemorrhage should be viewed with suspicion and no attempts at Credé's method should be made if the clinical signs of separation are not present.
6. In the presence of an attached placenta without bleeding, aseptic exploration under anesthesia should be made to determine the subsequent procedure.
7. Finally if no line of cleavage can be demonstrated hysterectomy should be done.



## PAPILLARY TUMORS OF THE RENAL PELVIS

By ALBERT J. SCHOLL, M. D., ROCHESTER, MINNESOTA

Resident Surgeon, St. Mary Hospital, Mayo Clinic

PRIOR to the advent of modern cystoscopic methods, the study of renal tumors was confined to necropsy findings; their clinical recognition was unusual. Gurli, in 1880 reviewing 14,630 cases of malignancy from Vienna hospitals, found only 16 clinically recognized renal tumors (1 in 914) while Reiche in 11,930 necropsies in cancer patients, found 80 (1 in 149). Albarran and Imbert in a review of the literature up to 1903 were able to collect only 585 cases of renal tumor. Taddel collected 435 cases published from 1903 to 1907. Tumors of the renal pelvis were even more difficult to recognize clinically than the large, bulky parenchymatous growths; the majority of the cases had been discovered at necropsy. Forty-two of Albarran's cases of renal tumor, 31 of Taddel's, and 9 of 652 cases collected by Kuater were primarily of the renal pelvis. Since then collected reviews of a comparatively large number of cases of tumor of the renal pelvis have been reported by Stuecaser, Mock, and Lower. Other reports have been limited to special pathological and clinical types. Savory and Nash, Judd, McCown, and Hrynitschak reviewed cases of papillary growth. Kretschmer in 1917 gave an excellent review of non-papillary tumors. Spies, in 1915 was able to collect 136 cases of various histological types. From 1905 to 1922 there were 273 cases of renal tumor treated at the Mayo Clinic, 13 of which were primarily of the renal pelvis, 8 being papillary epithelioma.

The majority of tumors of the renal pelvis are of papillary origin. In 18 of Albarran's 42 collected cases, in 21 of Taddel's 31 cases, and in 76 of Spies' 136 the tumors were of this type. Recently a number of cases of papillary tumors removed surgically have been added to the literature. Hrynitschak, in 1920 collected 68 cases of definite papillary growth, many of them surgical.

## ETIOLOGY

Ewing describes the disease colitis polyposa as an example of the transition from an inflam-

matory overgrowth to a malignant tumor. In 50 cases collected by Doering there were 37 deaths; malignant changes were found in 31. Similar changes occur in the urinary tract; long-standing irritation and inflammation are very probably factors in the formation of papillomata and epitheliomata. Rehn, in 1895 and Seyberth, in 1907 reported cases of papillary tumors in the bladders of dye workers, a result of chemical irritation. Goebel reported similar cases, the result of mechanical irritation of encysted bilharzia organisms. In the renal pelvis various irritative conditions, such as infection and urinary concretions probably result in similar inflammatory overgrowths. In one case observed in the Mayo Clinic, nephrectomy was performed for severe renal infection. Marked inflammation of the pelvic mucosa and a definite villous pyelitis were found (Fig. 1). There was also an area of leucoplakia of the pelvic mucosa (Fig. 2). Both of these conditions suggest inflammatory irritation. In another case villous inflammation and stone were found. In both of these cases there was marked round cell infiltration, edema, and fibrosis of the surrounding tissue. Calculi apparently are not important in the etiology of papillary tumors. Only a few cases of stone with papilloma have been reported; the stone is apparently a result of the same irritative factor which causes the epithelial proliferation. Kohlhardt also described a case of villous pyelitis, the result of long-standing inflammation. Orth believes that this villous or papillary inflammation may merge into and cannot be histologically distinguished from papillary tumors. In the examination of the grossly uninvolved mucosa and submucosa adjacent to papillary tumors of the renal pelvis, small villous, apparently inflammatory processes are often found differing from similar villous processes that are associated with infection or stone which are confined to the epithelial layer. The papillary processes associated with tumors sometimes involve the submucous tissue (Fig. 3). Kaul



Fig 2

Fig 2 Villous papillitis. Histologically similar to conditions found in association with papillary tumors of renal pelvis (A 7663) (X 100)

Fig 3 Leucoplakia of the renal pelvis looks as associated with villous papillitis. Both conditions prob-

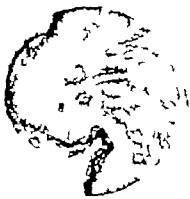


Fig 3

ably resulted from the same irritative factor (A 7663) (X 50)

Fig 3 Early stage in formation of papilloma of renal pelvis. Section from mucosa adjacent to papillomatous masses (A 8787) (X 50)



Fig 3

man attributes the development of papilloma to chronic exudative inflammation. He cites the case of a patient with a fistula between the renal pelvis and the duodenum caused by the sloughing of a renal stone into the intestine. For years particles of undigested food were passed through the urethra. At necropsy the ureter and renal pelvis were found to be greatly thickened, inflamed, and covered with small papillomata.

In most areas the mucosa between the papillary growths shows evidence of inflammation on the surface, but in some cases it is apparently normal. The submucous tissues almost invariably show the effects of inflammation—round cells and plasma cells, granulation and fibrous tissue with many large thin-walled blood vessels. Stoerk believes that the free epithelial surface injured by long-continued toxic or mechanical irritation which results in a regenerating fibrosis is an etiologic factor in the development of papillomata. The large blood vessels grow up toward the surface, branch out, and are covered with epithelium. Undue proliferation of epithelium and regenerating vessels eventually result in the tufted villous masses.

#### PATHOLOGY

In the early stages the tumors are small, often multiple, flat or thickly pedunculated and confined to the renal pelvis (Fig 4). They

spread rapidly and extensively, involving the calyces and sometimes the ureteral outlet. As a result of obstruction or invasion, the renal cortex may become extensively atrophied. In the late stages the kidney becomes a distended, sacculated, often infected mass with complete loss of function. In cases reported by Poll and Dickinson the entire pelvis and calyces were covered with fine villous masses. The kidney is generally moderately enlarged with slight pelvic dilatation, or the mass may be converted into a large dilated sac. The papillomatous growth may be felt through the pelvis as a soft doughy mass. It is sometimes impossible to detect anything abnormal from the external appearance, as in a case described by Bruett. Derewenko, in a similar case, opened the kidney and explored it digitally but found no growth. Seven months later it was necessary to remove the kidney on account of severe bleeding; four papillomata were found in the renal calyces.

Since the renal pelvis does not offer a free space for growth like that of the urinary bladder, the pelvis is rapidly filled and the papillomatous masses become matted together under tension so that they bulge from the pelvis when the kidney is opened. The ureter may be involved by direct extension, or by transplants which may stop at any of the normal constrictions (Fig 5). The most common site is the ureterovesical junction; here the growth



Fig. 4. Small pedunculated papillomata of the pelvic mucosa.

may project into the bladder and invade the surrounding mucosa. Occasionally the growth completely encircles and occludes the ureteral lumen. Often the ureter is dilated and thickened and the uninvolved mucosa shows evidence of chronic inflammation. As in the mucosa of the renal pelvis, there is an extensive round cell infiltration, edema and moderate fibrosis of the submucous tissues. Extension to the ureter was found in 6 of Albarran's 18 collected cases.

In both the renal pelvis and the ureter the individual papillomatous fronds are shorter and broader than similar growths in the bladder; there is a more extensive fusion of adjacent fronds, and atypical cell masses are more often seen (Figs. 6, 7, and 8). Histologically the growth in the ureter and pelvis contains more areas undergoing malignant degeneration than the comparatively more villous transplants in the bladder, and loss of cellular polarity and regularity, with the presence of numerous mitotic figures, may occur in a grossly benign tumor, as in papillomata of the bladder. In certain cases the histological dif-

ference in the tumors in the bladder, ureter and renal pelvis is only slight. Lower reported a case in which sections from the kidney, ureter and bladder were histologically similar.

The majority of papillary tumors of the renal pelvis are histologically similar to the malignant papillomata, or the papillary epitheliomata occurring in the urinary bladder. In an occasional case glandular changes have been noted in cells of the papillary structure. Grohé reported a case of adenocarcinoma of the renal pelvis; the pelvis also contained a number of small papillary excrescences. Malignant papillary adenomata of the body of the kidney of the type reported by Jadd may penetrate to the pelvis, in which case the site of origin is questionable. Hryntschak considered only 6 of his 68 collected cases as definitely benign, basing his opinion in most instances on clinical data. Morris asserts that even though villous growths in the renal pelvis may be histologically benign, they are far from being clinically benign. If a careful histological study is made of sections from various parts of the growth, small circumscribed areas of malignancy will almost invariably be found, even in the small pedunculated, grossly benign papillomata. In spite of the histological report it is impossible definitely to determine, after an examination of the initial lesion, what the outcome will be. Bruett, who observed several cases for a number of years, says that papillomata which, after prolonged observation, prove themselves unquestionably benign are very rare. A number of reported cases, apparently benign primary lesions, have been followed by malignant extensions or recurrences shortly after operation. Barth reported a benign papilloma of the pelvis with metastatic cancer in the regional glands. Reynes removed a kidney for a benign growth which recurred as cancer 2 years later. In a case of Israel's there was a benign growth in the renal pelvis and bladder which later recurred as cancer in the scar of operation. Nephrectomies for benign lesions with development of generalized carcinomatosis are reported by both Derewenko and Pantaloni. Late recurrences also occur. Tikhoff reported a case of recurrence in the scar 10 years after the removal of a benign

papilloma and Bland-Sutton a similar case 11 years after the original operation. In contrast to this, recurrences occasionally develop very rapidly and extensively. Asch removed a kidney with a small papilloma of the pelvis. Two months later there was a secondary deposit in the bladder about 7 centimeters in diameter. The bladder was resected 6 weeks later the patient died and metastasis to the scar was found. Zuckerhandl, in a similar case noted the recurrence of twenty tumors 1 or 2 centimeters in diameter in the bladder 6 months after the removal of a benign papilloma of the kidney. The bladder was not involved in either case at the first examination. On the other hand, Drew and Barker report malignant lesions in the kidney with benign secondary deposits. Possibly the primary exciting cause continued resulting in further hyperplasia of the original focus after the occurrence of extension to the bladder.

#### DIAGNOSIS

Hæmaturia is the most common and often the only symptom observed in the early stages of tumor of the renal pelvis. It is generally profuse, continuous, or intermittent, with only short intervening periods, and lasts from several days to several weeks. In papillary tumors the excessive vascularity and vulnerability result in severe hæmorrhages which often follow slight injury or violent muscular movements. The bleeding may almost exanguinate the patient, as in a case described by Blum. Morris reported a patient with a papilloma of the renal pelvis who died from severe hæmorrhage of 7 months duration. The hæmorrhage occurring with tumors of the renal parenchyma is generally of short duration and irregular with free periods of several months. The bleeding called "essential hæmaturia" may be of long duration, but it is generally not consistently profuse, and the passing of blood clots, common with papillary tumors, is comparatively rare. In tumors of the pelvis the function in most cases is markedly reduced. In essential hæmaturia it is generally normal. Braasch says "If cystoscopy reveals a papillary tumor of the bladder together with a unilateral renal hæmaturia the probable diagnosis would



Fig. 5. Section of ureter and bladder wall containing transplants from papillary carcinoma of renal pelvis.

be pelvic epithelioma with vesical metastasis. When there is no tumor of the bladder the diagnosis becomes more difficult. In the majority of cases the diagnosis can be made quite certain by means of pyelography. In the first place, if the growth is large enough it may occlude the pelvis entirely. Usually however there is an irregular partially obliterated outline of the pelvis together with dilatation or elongation of one or more calyces. It must be remembered that partially organized blood clots in the renal pelvis may cause an outline simulating filling defects." Thomas Colston, and Landon and Alter report cases of papillary tumors in which such a defect was noted.

Pain is not a prominent symptom, and when present it is generally dull and constant. There may be attacks of sharp renal colic associated with the passage of blood clots, or



Fig. 6

Fig. 6 Delicate arborescent papilloma of bladder transplanted from papillary epithelioma of renal pelvis (X 200) (X 50)



Fig. 7

Fig. 7 Fusion and setting together of adjacent broad papillary tumor of the renal pelvis (X 275/30) (X 20)



Fig. 8

Fig. 8 Atypical cell forms in rapidly growing papillary carcinoma of the renal pelvis (X 300)

due to a transient hydronephrosis, or hæmatonephrosis resulting from ureteral obstruction. The obstruction may be caused by the passage of blood clots or fragments of tumor or by ureteral kinking from ptosis of the heavy kidney. Israel calls attention to the occasional presence of an intermittent abdominal tumor, a hæmatonephrosis due to ureteral obstruction and bleeding. The passage of a blood clot or papillomatous fragment may be followed by large quantities of bloody urine coincident with the disappearance of the tumor and relief from pain. Lion reported a case of long-standing renal colic which ceased following the passage of a fragment of tumor and great quantities of urine. Stoerk, and Hoché and Damage report the passage of multiple fragments of tumor in the urine. The pelvic dilatation resulting from the obstruction is sometimes very great. Cope reports the case of a pelvis holding 3 pints and Reynolds of a renal distention of 14 pints both associated with tumors of the renal pelvis.

The duration of symptoms, in most cases of papillary tumors is comparatively short, generally from 6 to 12 months. Occasionally the symptoms, especially the attacks of hæmaturia are of many years duration. Busse reported the case of a patient who had hæmaturia for 20 years. Thornton reported a case of attacks of renal colic for more than 2 years, and intermittent hæmaturia for 9 years.

Cystoscopic examination may reveal a normal bladder. Sometimes a small papillomatous tuft is found protruding from the ureteral orifice or there may be a number of papillomatous masses, or a single flat, rounded growth surrounding or completely occluding the ureteral opening. In certain cases, numerous small growths are found extensively scattered over the mucosa of the bladder or there may be one or more minute papillomata directly in line with the ureteral outflow. The secondary tumors in the bladder are usually flat and low and do not have the wavy arborescence and villosity which occurs with primary papilloma of the bladder of the same size. In some cases extensive secondary transplants in the bladder may completely cloud the primary renal or ureteral origin, especially if the ureteral orifice is obscured by the tumors. Occasionally in resection of the bladder, presumably for a primary tumor the lower portion of the ureter is cut across and papillomatous masses are found protruding from the cut ends giving a clue to the renal involvement. This may sometimes be misleading, as the growth may originate primarily in the bladder and extend upward through the ureteral opening. In a case observed at the Mayo Clinic an extensive papillary epithelioma in the region of the ureter was removed, with the lower 3 centimeters of the ureter which was moderately dilated. A few tufted papillae were found protruding from the cut

end of the vesical portion of the ureter. The upper end was ligated and dropped back in the wound. Later the remaining portion of the ureter and the kidney were removed. The kidney was markedly atrophied from infection and distention, but there was no evidence of tumor either in the kidney or remaining ureter.

#### PROGNOSIS

Due to the greater friability and more frequent fragmentation, the villous forms of papilloma develop transplants more readily than the flat or more malignant types. Of 25 cases collected by Mock, in which operation was performed, and the growth considered papillary carcinoma, 23 recovered from the operation. Eighteen of the patients were traced after operation of these only 5 remained well, the others died or developed recurrences.

In papillomatous tumors recurrence is almost a certainty unless a complete ureterectomy including resection of the ureteral orifice is carried on, either at the time the kidney is removed, or later. The transplants to the bladder may be exceedingly numerous and persistent, necessitating frequent, regular cystoscopic examinations with prompt treatment of all newly developing growths. The 8 cases of papillary tumor of the renal pelvis reported were treated at the Mayo Clinic between February 1910 and February 1922, the early history of 3 being reported by Judd in 1919.

#### REPORT OF CASES

**CASE 1 (A383357)** H M H a man age 48, came to the Clinic February 6, 1912. One year before following trauma, he had had sudden pain in the back. 2 days later blood was passed with urine. This bleeding continued with only a few remissions up to the time of his registration at the Clinic. When he remained quiet the urine was but slightly stained, but when he was moving about freely the urine resembled pure blood. There was no pain, colic, dysuria, or frequency. He had not passed stones or blood clots. He felt that he was gradually becoming weaker. He had been cystoscoped and a small papilloma of the bladder had been fulgurated 6 months before and 6 months later a recurrence of the bladder was also fulgurated, and the pelvis of the right kidney is aged with silver nitrate on account of bleeding from the right side.

Physical examination was negative. The urine contained large amount of blood, but no pus. The



Fig 9. Extensive papillary carcinoma of the renal pelvis in completely destroyed kidney. The ureteral orifice obstructed, no transplants in ureter or bladder (A383357).

hemoglobin was 50 per cent and the erythrocytes 3,500,000. The phenolsulphonphthalein test was 60 per cent, and the blood urea 34 milligrams for each 100 cubic centimeters of blood. Cystoscopic examination revealed hemorrhagic urine. There was a villous papilloma by centimeters on the left posterior wall of the bladder. The left ureteral orifice was normal. There was periodic dribbling of pure blood from the right orifice. Urine was not secreted from the right side in 5 minutes.

At operation, February 16, right nephrectomy and partial ureterectomy was performed. The renal pelvis was dilated and found to contain a soft mass; very little renal tissue remained. The ureter was cut with the cautery ligated, and dropped back. On account of evidence of infection the remainder of the ureter was not removed. Following operation, the patient developed thrombophlebitis of the right leg and remained in the hospital 44 days. Further treatment of the bladder was delayed several months. Cystoscopic examination June 1912 revealed two small papillomata of the bladder; these were completely fulgurated. The right orifice was not seen June 26 through a right rectus extraperitoneal incision, the remaining portion of the ureter and a segment of the wall of the bladder were removed with the cautery. The ureter was very adherent. The patient convalesced uneventfully and left the hospital on the fourteenth day.

The kidney was large, distended and thin walled. The entire pelvis was filled with a large, bulging, papillomatous mass (Fig 9). Areas not covered by the growth, the mucous membrane of the pelvis and calyces, as markedly thickened and fibrosed. The kidney weighed 75 grams. The ureter was completely blocked by the tumor at the ureteropel-



Fig.

Fig. Solid papillary carcinoma of the renal pelvis (A3337) ( $\times 50$ )



Fig.

Fig. Area of localized malignancy in papilloma of the renal pelvis (A3337) ( $\times 150$ )



Fig.

Fig. Fusion and matting together of adjacent foci in papillary tumor of the renal pelvis (A34043) ( $\times 50$ )

vac junction. The lower segment of the ureter and ureteral orifice are not normal. The growth was malignant papilloma composed of branching papillomatous masses. There was extensive fusion of adjacent fronds and a number of areas with definite malignant changes. These areas were made up of large irregular round cells, with many typical mitotic figures and a lack of the usual elongated cellular regularity and disposition (Figs. and ).

CASE (A34054) J. M., a man, age 66, came to the Clinic February 8, 1930, on account of pain in the left kidney area of years duration. The pain was dull and heavy and came in attacks lasting for weeks. He frequently passed coffee colored urine, and had lost considerable weight and strength. The pain had been almost constant for the past 6 weeks, and for the past 3 weeks mass had been noted in the left abdomen.

Examination revealed large, irregular, no tender cystic and freely movable mass extending about 6 centimeters below the left costal margin. Ballottement could be obtained between the costo-vertebral angle and the anterior abdominal wall. A moderate sized varicocele was found on the left side. The urine contained pus and blood, and the renal function was 60 per cent. Roentgenographic examination of the stomach, colon, and urinary tract was negative. Cystoscopic examination revealed few small papillomatous tags projecting from the left meatus. The right ureteral opening was normal, and normal urine was obtained on catheterization. The left opening was contracted, but normal appearing urine as being secreted. On catheterization of the left ureter hemorrhagic urine was obtained, and there was no phenolsulphonephthalein return from this side in 5 minutes. The right kidney drained poorly but the phenolsulphonephthalein return was fair.

At operation, February 3, the kidney was found to be hydronephrotic and soft, and the renal tissue

mostly destroyed. The ureter, which was apparently normal, was cut, ligated, and the lower segment dropped back in the wound. There was evidence of tumor near the spine, but the patient's condition contra indicated further exploration. The patient had no trouble following operation, and left the hospital on the twenty third day. Ten weeks later he was given a complete roentgen ray radiation of the involved area. He felt better immediately after the operation, but rapidly lost strength and weight and died 6 months later.

On section, the renal pelvis and calyces were found to be almost completely covered with stubby papillomatous masses. The growth was papillary epithelioma, composed of flat, irregular masses of epithelial cells. In few areas the papillary outline and the axis of the central connective tissue was retained (Fig. ). The cells were large, with clear outlines and distinct nucleoli; they are arranged without any definite formation or polarity. There was a tremendous thickening and fibrosis of the pelvic wall, with extensive plasma cell and round cell infiltration, there were also numerous scattered areas of tumor cells which filled many of the underlying blood vessels and lymph spaces. In the few areas not involved in the process, the pelvic mucosa was thickened and irregular, merging gradually into adjacent masses.

CASE 3 (A338750) R. M., a man, age 46, came to the Clinic October 3, 1930, because of attacks of painless hematuria that had existed the past 4 years. The attacks lasted for 3 days and occurred every 3 or 5 months. The attacks are longer and more frequent when the patient is working on his farm. While resting the hematuria almost disappeared. During the last 3 years urination had been moderately frequent. For the last months dull heavy pain in the right lumbar region had kept the patient from working. There had been no loss of weight, and his appetite was normal.

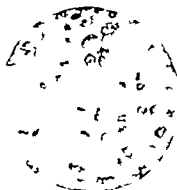


Fig. 3. Rapidly growing transplant of bladder from papillary epithelioma of renal pelvis. Numerous mitotic figures are present. (A358759) (X 450)

The physical examination was negative, but the urine contained large amounts of blood, and the haemoglobin was 75 per cent. Roentgenograms of the kidneys, ureters and bladder revealed nothing abnormal, and the phenolsulphonephthalein test was 45 per cent. At cystoscopic examination multiple flat papillomata of the bladder involving several distinct areas, especially the left orifice were found.

November 3, the bladder was opened suprapubically and a large, flat papillary growth removed from the left wall and base, together with a number of smaller tumors. One small growth was also excised from the right base. The left ureter opened in the center of the large growth. In cutting across the ureter 3 centimeters above the bladder small papillomatous masses protruded from the cut end, indicating possible involvement of the upper urinary tract. The patient had an uneventful convalescence, and on the fourteenth day (December 6, 1931) left nephrectomy and ureterectomy was performed. The kidney was found to be moderately hydronephrotic and the pelvis was distended with a soft tumor. The patient left the hospital 17 days after the second operation with the kidney wound healed. He remained under observation for 6 weeks, during which time both wounds healed completely. Several months after leaving the Clinic, his general health began to fail, and he died 9 months after the first operation, presumably from recurrence.

The kidney weighed 270 grams. It was small and fibrotic, with moderate semi-solid pelvic dilatation. On section, the tissue was found to be markedly thinned; the calyces were extensively dilated and filled with an extensive flat papillary growth. The pelvic wall was greatly thickened, but in most areas it was macroscopically free from tumor. The ureter was greatly thickened and dilated, and sharply kinked at several places. It was free from tumor as far as the uretero-vesical junction; here an area 3 centimeters in length, almost completely blocking the lumen, had been cut through at the first opera-

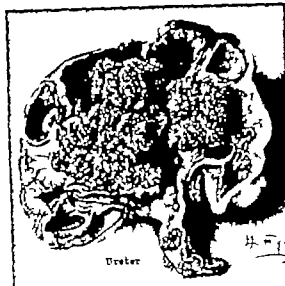


Fig. 4. Papillary carcinoma of the renal pelvis. The ureteral outlet is patent, permitting ureterocystostomy to pass to the lower ureter and bladder. (A358756)

tion. In the sections of the ureter removed at the first and second operations, the growth was flat and composed of short, stubby papillomatous masses with very little branching or free arborization. The largest tumor removed from the bladder measured 7 by 5 by 2 centimeters and was composed of firm, compact, flat, papillary masses of the type usually described as papillary epithelioma. Histologically the sections from the pelvis, ureter and bladder confirmed the diagnosis of solid papillary epithelioma. The cells, which were large and irregular in size and took the stain deeply, were massed together with only a small amount of supporting tissue. Remnants of altered papillae indicated the original papillary structure. In the kidney the tumor had broken into and extensively involved the remaining parenchymal tissue. The malignant cells from the growth in the bladder were larger and more irregular than those from the kidney or ureter (the process had evidently been more rapid in the bladder (Fig. 3). There was widespread round cell infiltration, with a moderate fibrosis in the bladder wall, but no evidence of malignant extension through the bladder wall was found.

CASE 4. (A67588) W. S. D., a man, age 65, came to the Clinic April 9, 1919, complaining of hematuria of 3 years duration. It occurred in spells lasting several days once every 4 or 5 months. There had been sharp, severe pain in the region of the left kidney recently; this had developed into constant ache. Six months before, a small stone had passed through the urethra without pain.

The physical examination was negative except for tenderness in the upper left abdomen. The urine



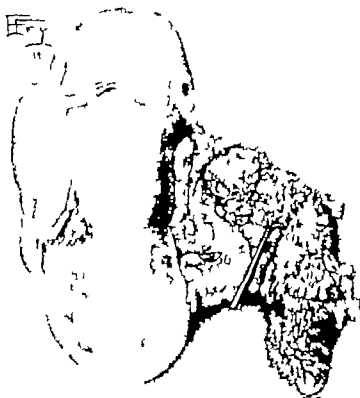


Fig. 5. Papillomatous masses protruding from the opened bony pelvis. (A. 3018)

contained slight amounts of albumin and pus. The phenolsulphonphthalein test was 65 per cent. Cystoscopic examination, April 1, 1930, revealed normal bladder. There was no secretion from the left ureteral orifice and the ureter was obstructed about 5 centimeters from the bladder.

April 2, 1930, through left rectus extraperitoneal incision, the left ureter was found to be edematous and attached to the surrounding tissues about the brim of the bony pelvis. It was freed by dissection and an obstructing mass was felt. The ureter was opened and an organized blood clot was forced out by the intra-ureteral tension, followed by a pint of purulent urine. It was possible to pass a probe apparently into the pelvis of the kidney and down as far as the bladder. The patient had an uneventful convalescence, leaving the hospital on the fourteenth day.

At cystoscopic examination May 3, the function of the left kidney was almost normal. A pyelogram revealed few scattered dilated calyces, with large, dimly outlined pelvis. The patient did not desire operative procedures at this time. March 8, 1930,

he returned. He had almost constant hematuria since leaving the Clinic, and practically always a little blood in the urine, and sometimes clots. He had occasional attacks of pain in the left side. Urinalysis revealed both pus and blood in large amounts. The phenolsulphonphthalein test was 55 per cent. Cystoscopic examination March 10, revealed occasional spurts of hemorrhagic urine from the left meatus and frequent spurts of clear urine from the right. There were several blood clots in the bladder. March 11, through a left lateral incision, a fixed hard kidney was removed with 8 centimeters of the ureter. Indurated tissue which was found posteriorly was not removed. Two clamps were left on the pedicle on account of the friability of the tissue and the induration around the pedicle. The remaining portion of the ureter was ligated and dropped back into the scald. The clamps were removed on the fourth day. The patient convalesced uneventfully and left the hospital on the fourteenth day. September 2, 1931, the patient's general condition was excellent. There had been no recurrence.

The kidney weighed 490 grams. A large, papillomatous mass filled the pelvis and extended up into the renal tissue. The mass was covered with short, stubby protrusions, and extended down into the ureter blocking the pelvic outlet. Histologically the growth was composed of short papillae which, through compression and fusion of adjacent fronds, had become matted together into a comparatively solid mass. The cells were irregularly situated around remnants of altered papillary tips. They were irregular in size and shape, and contained prominent nucleoli. There were a moderate number of mitotic figures. The growth was of moderate malignancy and was histologically similar to the flat, superficial type of papillary epithelioma of the bladder. The fact that there was no extension into the bladder from a kidney so extensively involved was possibly due to the obstruction at the ureteropelvic outlet.

CASE 5. (A 56716) G. G., a man, age 34, came to the Clinic January 8, 1909, complaining of attacks of painless hematuria of 30 months duration. Sixteen months before, he had had several attacks associated with pain on the left side, following which he passed a number of blood clots. For the last 9 months he had had almost constant hematuria. He was 30 pounds under normal weight, and complained of frequent headaches and rapid, forceful heart beats.

The urine contained large amounts of albumin and red blood cells, and a small amount of pus. The hemoglobin was 45 per cent, the erythrocytes 340,000. Roentgenograms of the kidneys, ureters, and bladder were negative. The phenolsulphophthalalein test was 35 per cent. Cystoscopic examination revealed a small papilloma at the left orifice; this was destroyed by fulguration. The right orifice was normal. There was increased secretion from this side and phenolsulphophthalalein return of 5 per cent in 5 minutes. The ureteral catheter encountered an impassable obstruction in the left ureter 7 centimeters from the bladder and no urine was obtained. February 7 through May 10 lateral incision, a lobulated kidney about twice normal size with a dilated pelvis and the upper third of the ureter, were removed. The pelvis was found to be filled with a grossly malignant papillomatous mass which extended to the ureter. The patient was then turned on his back, and the ureter removed down to the bladder through low left rectus incision. The convalescence was uneventful and the patient left the hospital on the eleventh day. October 7 the patient returned for examination, although he had had no trouble. Cystoscopic examination revealed recurrence in the left bladder wall, 3 centimeters in diameter. November 7 through a suprapubic incision a portion of the bladder including the growth and the stump of the ureter was removed. The patient convalesced from the operation readily and left the hospital on the fourteenth day. May 4, 1910 he returned, complaining of frequency and burning at micturition. Cystoscopic examination

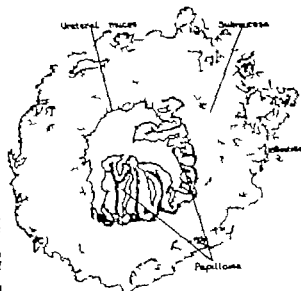


Fig. 6. Transplants from papilloma of the renal pelvis to the lower portion of the ureter.

revealed a flat, sessile mass, 2 centimeters in diameter with a necrotic base, on the right wall. May 10, suprapubic cystostomy was performed, and a 60 milligram radium capsule applied directly over the growth for 6 hours, being held in place by fine catgut. The remainder of the bladder was in good condition. For several months afterward the patient had a severe cystitis with swelling, tenderness, and a boggy condition of the prostate. On subsequent cystoscopic examinations in 8, 18, and 7 months, there was no evidence of recurrence, capacity of the bladder was normal and there was a definite area of scar formation where the radium had been applied.

The kidney was large and dilated, and most of the parenchyma trophied or destroyed. The mass filling the pelvis was 6 centimeters in diameter and was composed of papillomata, some of fine texture, but the greater number short and stubby; they did not have the fine arborescence of similar tumors found in the bladder. The growth extended into the calyces and down into the ureter (Fig. 14). There were several papillomata from 1 to 3 centimeters in diameter scattered in the central portion of the ureter which were grossly similar in appearance to those in the renal pelvis. In the bladder the small, rounded arborescent papillomata did not differ materially from the apparently benign growths usually found in the bladder. The tumors were loosely held together, most of them pedunculated, and the individual fronds were more wavy and arborescent than those of the kidney. Histologically, the renal mass was composed of papillomata of moderate length fusion of adjacent papillae was rare. The tumor cells in most areas conformed to

the usual benign appearance of papilloma. In few areas the cells were large, irregularly disposed, and contained prominent, deeply staining nuclei. In the ureter there was more fusion and matting of the papillary masses, and in some areas of the connective tissue, supporting structures and blood vessels had disappeared. The cells were more irregularly disposed than were those in the renal mass. In some areas there was a slight cellular hyalinization, with a tendency toward epithelial pearl formation. In the bladder the papillae were long and arborescent, and the individual cells small and regular in size and shape but only rarely did they conform to the usual benign, transitional appearance of simple papillomata.

**CASE 6 (A387879)** A M K man, age 49, came to the Clinic September 3, 1919, because of hematuria. Eleven months before, his urine had been tinged with blood for 4 days. Similar attacks had occurred 6 months and 3 months before, the latter lasting 3 weeks. Two months before, he had had a sharp attack of pain on the left side, this lasted hours and terminated with the passage of blood clot and large quantity of bloody urine. He had had almost constant hematuria for 3 days, and recently frequency of micturition, nocturia and pyuria.

The physical examination was negative. The urine contained large amounts of pus and blood. The phenolsulphonophthalein test showed a 40 per cent return of the dye in 1 hour and 5 minutes. The hemoglobin was normal, and roentgenographic examination of the urinary tract was negative. The left kidney was palpable. Cystoscopic examination revealed a normal bladder, both ureteral orifices appeared to be normal, clear urine spouting from both sides. On catheterization the urine from the right ureter was normal, that from the left was hemorrhagic.

At operation, September 11, 1919, a normal sized kidney was exposed through left 11th lateral incision. A tumor was felt in the renal pelvis which extended into the upper pole of the kidney. The peritoneal cavity was opened and the opposite kidney explored and found to be normal. The left kidney was removed, together with 10 centimeters of the ureter which was dilated and filled with blood clots. The patient recovered uneventfully and left the hospital the tenth day. September 3, 1920, he returned to the Clinic. He had gained in weight and his general condition was excellent. He had had moderate frequency and dysuria for several months, and two slight attacks of hematuria. Roentgenograms of the urinary tract were again negative. The renal functional test was 35 per cent; the urine contained pus and blood. Cystoscopic examination revealed small papillomata, 1 centimeter, in the base of the bladder and also one at the edge of the ureteral orifice. Both were completely fulgurated. April 8, 1923, the patient again returned. His general health was good and there had been no urinary symptoms except one attack of hematuria

one week before. The urine still contained pus and blood and the functional test was 40 per cent. Cystoscopic examination revealed smooth, fleshy recurrent growth, 2 centimeters in diameter surrounding the left ureter. May 28, 1923, left ureterotomy was performed and the tumor bearing area in the bladder resected. The patient's convalescence was uneventful and he left the hospital on the nineteenth day. He was cured. September 24, 1924, cystoscopic examination revealed another recurrence, 1 centimeter in diameter on the left. Four hundred milligram bougie radium emanations in four tubes was planted directly into the tumor through the cystoscope. Several weeks later the growth was thoroughly fulgurated. December 7, 1925, cystoscopic examination revealed extensive radium cystitis, but no evidence of recurrence. May 1, 1926, the patient returned for observation. A small fleshy circumscribed recurrent papilloma was found on the right wall. A 60 milligram radium capsule was applied to the growth for 1 hour. Later this area showed small recurrent growth on the left wall which was completely fulgurated. September 1, 1927, the patient returned complaining of slight frequency of micturition and moderate dysuria. His general health was good. Cystoscopic examination revealed small papillomatous recurrence in the sphincter which, with two small areas in the posterior wall, was completely fulgurated.

The kidney was slightly larger than normal. The pelvis was dilated and thickened and contained a mass 4 centimeters in diameter in its upper half. It was somewhat hard and consisted of small, strobiliform papillomata matted together. The ureteral orifice was open and was not involved in the tumor. There was very little destruction of renal tissue, although the growth extended into the renal parenchyma at the upper pole of the kidney. The lower end of the ureter removed at the second operation contained several localized masses of flat papillomata, each about 1 centimeter in diameter, which encircled the ureter in two places, filling and blocking the ureter. The upper end of the ureter near the point of ligation was thinned and dilated, probably from retained inflammatory products of the obstructed segment. At the insertion of the ureter into the bladder there was a mass 3 centimeters in diameter directly continuous with the ureteral growth. Histological sections from the kidney, ureter and bladder are not essentially different in structure; they are composed of heavy papillomatous masses matted and fixed together. In many areas the cells are regular in size and shape, having the usual palisade arrangement of bladder papillomata. A number of small, localized areas of deepening definite malignant change were found. In these areas the cells were large, irregular in size, deeply stained, and contained mitotic figures. Sections of the surrounding pelvic mucosa taken from uninvolved areas revealed definite villous papillitis. In most sections the epithelial mucosa alone was involved in this process, but occasionally the submucous tissue also projected up into the small

villous irregularities. There was extensive round cell infiltration and moderate fibrosis in the deeper submucous tissues.

CASE 7 (A123016) A W., a man, age 55 came to the Clinic October 25, 1917, complaining of persistent hematuria of 9 months duration. There had been no frequency nor dysuria until a few weeks before. Seven months before, at a cystoscopic examination, it had been found that the left ureter was partly obstructed and the urine from that side bloody.

General examination at the Clinic was negative. The urine contained pus and red blood cells in large amounts. The hemoglobin was 65 per cent. The phenolsulphophthalein return was 40 per cent in 1 hour and 5 minutes, and the blood urea was 57 milligrams for each 100 cubic centimeters of blood. Roentgenograms of the kidneys, ureters and bladder were negative. October 29, cystoscopic examination revealed a normal bladder containing clear urine. The right ureteral orifice was normal. The left was inflamed, and oedematous. It did not contract, and there was no secretion during 5 minutes observation. The secretion from the right ureter was rapid and clear. Ureteral catheters were inserted in both ureters. A differential phenolsulphophthalein test returned 20 per cent from the right ureter and nothing from the left in 5 minutes. A pyelogram of the left kidney revealed only a few irregular shadows.

November 7 the kidney was explored through left rectus incision. This wound was closed, the patient turned on his right side, and a nephrectomy and partial ureterectomy performed through a left Mayo lateral incision. The ureter as very fragile, tearing readily a section 2 centimeters in length was removed. The lower 5 centimeters was normal. The wound healed readily and the patient left the hospital on the fourteenth day. December 5, 1918 the patient returned to the Clinic. Four months before he had passed blood once, and a month before he had passed several blood clots. The urine contained blood. Urination had been moderately frequent. The phenolsulphophthalein return was 40 per cent in 1 hour and 5 minutes. December 7 cystoscopic examination revealed a growth at the site of the left ureteral orifice with an irregular cauliflower appearance. January 3, 1919, the bladder was opened through a suprapubic incision. A papiloma 3 centimeters in diameter projected from the left ureteral orifice and a smaller arborescent growth as found in the middle line posteriorly. A portion of the bladder 6 centimeters in diameter, with the remaining segment of ureter was removed. The peritoneum was opened and closed with plain catgut. The patient's convalescence was uneventful and he left the hospital on the second day after the fifth day. October 3 he returned complaining of tenderness in the inguinal region and of frequency of urination. November cystoscopic examination revealed multiple malignant papillomata in the base of the bladder. The patient was given 3,350 mil-

gram hours of radium (2,800 milligram hours in suprapubic pack, 350 milligram hours rectally and 200 milligram hours direct to the growth through the cystoscope) and allowed to go home. Three months later he returned, complaining of frequency and urgency. Cystoscopic examination, February 9, 1920, revealed that the tumors seen at the last examination had increased markedly in size. March 24, a third operation was performed, the growths in the bladder being excised by cautery. The patient left the hospital with the bladder wound healed on the twenty-fourth day after operation. Cystoscopic examination 6 weeks after the operation did not reveal evidence of malignancy in the bladder. April 4, 1920, three small recurrent growths were removed by fulguration. January 28, 1921, cystoscopic examination revealed multiple recurrent growths at the base of the bladder. The growth was rather inaccessible and the patient intolerant to fulguration. The general condition and renal function were excellent. February 4, 1921, the fourth operation was performed. The bladder was opened through a suprapubic incision and multiple growths were excised and their bases cauterized. It was also necessary to remove the prostate in order to reach the prostatic urethra, which was involved in the growth. The patient's convalescence was fairly normal until the twentieth day when he became uræmic. He died March 8.

Necropsy revealed marked right pyelonephritis in an extremely large dilated kidney. There were also fatty changes in the liver and myocardial degeneration. The right kidney was small and its pelvis markedly dilated and thickened. Only a small amount of kidney tissue remained. The pelvis and calyces, also markedly dilated, were filled with short, stubby papillomatous masses extending into and almost completely blocking the ureter (figs. 15 and 16). The pelvis between the areas of growth was thickened, rough, and occasionally fibrosed. The wall of the ureter was thickened. The upper 5 centimeters was almost completely covered by short, stubby papillomatous protrusions, similar to those of the renal pelvis. The growths removed from the bladder at the last three operations were similar. They varied in size from 1 to 4 centimeters in diameter, were looser and the villi were long and freer than those of either the pelvis or the ureter. The renal mass as composed of fronds of moderate length, with the palisade arrangement of benign papillomata. Fusion of adjacent fronds was common. The supporting connective tissue and the central blood vessels of individual fronds or of small groups of fronds came directly from the underlying submucosa. There was no extensive pedunculation. The epithelial coverings of the papillae were readily traced as a continuation and proliferation of the normal transitional mucosa. There was moderate oedema in the submucosa, but no evidence of invasion by the tumor. In the ureter the fronds were short and stubby. In many areas they were completely fused with large cell masses. There was no

free any branching. In some areas the central supporting axis had completely disappeared, the growth being lost to papillary structure. There was extensive round cell infiltration, fibrosis, and thickening of the submucosa. In the bladder the folds were much longer and thicker than those of either the kidney or ureter, having the usual wavy arboraceous appearance. Benign or moderately malignant papillomata of the bladder. In certain areas the regularity of the palisade arrangement had been lost, the individual cells being irregularly disposed and staining deeply. In a few areas there was mitotic activity of the dividing folds, with loss of papillary formation, similar to that occurring in the kidney. The adjacent mucosa of the bladder was distinctly thickened, forming papillary irregularities which gradually tapered off to normal mucosa. Sections from the three organs indicated a moderately malignant process.

CASE 8 (A34904) M. A. W. man, age 47, was examined in the Clinic February 19, 1907. For 30 years he had had attacks of right renal colic at intervals of from several months to several years. Between attacks he was generally quite well. For the past 3 years the attacks had been more frequent and for the last year pain had been almost constant in the right renal area. The patient had lost 40 pounds in weight and his urine, as tasted, had blood most of the time. Physical examination revealed a cystic mass in the upper right abdomen. The urine contained albumin, pus and blood. The hemoglobin was 70 per cent. A roentgenogram of the urinary tract revealed several small shadows in the right renal area. Cystoscopic examination revealed normal bladder mucosa. The left ureteral opening was normal in appearance. The right orifice was eroded and spouting cloudy urine. Catheters were passed in both ureters; the urine from the right contained pus, from the left it was normal.

March 1910, right nephrectomy was performed through a lateral incision. The renal mass was so large that it was necessary to break the ribs in to remove it. Two pairs of clamps were left on the pedicle; these were removed the third day. The patient convalesced as he anticipated, but he died suddenly 5 months later.

The kidney was tremendously dilated, the thinned out pelvic wall. All the parenchymatous tissue had completely atrophied and the pelvis contained calyces filled with soft, tumorous mass, covered by short, irregular papillomatous projections. The ureteral outlet was filled with the growth. Several stones, a centimeter in diameter, were found free in the pelvis. The tumor consisted mainly of actively malignant cells arranged in papillomatous formation around the central axis of connective tissue. The cells are large and irregular with clear outlines. In some cases individual papillae show regular arrangement of cells, admitted that this tumor belonged primarily to the group of papillary epithelioma. In other areas the central connective tissue stalks are retained, but the cells

were larger, more irregularly disposed, with an increased amount of protoplasm and large, deeply staining, prominent nuclei. The cells in this area resembled the papillary desmocarcoma type, which is not infrequently found ranging in the parenchymatous portions of the kidney.

#### SUMMARY

The majority of tumors of the renal pelvis are papillomatous. Various irritative conditions, infection and stone are predisposing factors in the development of these tumors. The growths may be small pedunculated, and grossly benign, or they may completely fill the renal pelvis, blocking the ureteral outlet and by obstruction and invasion convert the kidney into a functionless dilated sac.

On cystoscopic examination the bladder may appear normal. Small papillomatous transplants may be found protruding from, or surrounding the ureteral orifice. In some cases multiple small transplants are scattered extensively over the mucosa of the bladder.

The papillary growths in the renal pelvis as well as those in the ureter are more compact than the transplants to the urinary bladder. As in most papillomatous tumors of the bladder, numerous areas in the growths in the renal pelvis are undergoing malignancy. The majority of tumors of the renal pelvis are malignant histologically. Clinically the transplants to the lower urinary tract, extension to neighboring tissues and the local recurrences make these tumors all potentially malignant.

Because of the frequency with which the ureter is involved, and the repeated recurrences after nephrectomy, a complete nephroureterectomy is essential to insure even partial success.

There were 8 papillary tumors of the renal pelvis in the series; all were histologically malignant. Three patients died from 5 to 9 months after the operation, one of whom had a transplant to the ureter and another a large secondary growth in the bladder. A fourth patient died from uremia 4 years after a nephrectomy. During these 4 years the patient had repeated multiple transplants which were treated by removing the ureter by resecting the bladder and by extensive fulguration. Four patients are still alive, two are

free from recurrence of transplantation of the growth one  $2\frac{1}{2}$  years, and the other 4 months after the removal of the diseased kidney and ureter. The remaining two patients have had repeated transplants to the bladder requiring persistent treatments at the present time both patients are well one 2 years, the other 3 years after the first operation.

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INTRACRANIAL HÆMORRHAGE IN THE NEWBORN<sup>1</sup>

By WILLIAM SHARPE, M.D.

A. S. MACLAIR, M.D. NEW YORK CITY

From the Department of Neurosurgery, New York Polyclinic Hospital and Medical School

**I**NTRACRANIAL hæmorrhage of the newborn is a condition which is mentioned in most of the modern textbooks but few pages are devoted to the detailed discussion of the subject. This malady is of far greater occurrence than is commonly believed. Holt (1) quoting Cruveilhier states that at least one-third of the deaths of infants which occur during parturition are due to meningeal hæmorrhage.

In the past few years more interest has been evinced in this subject as is shown by the increased number of papers published (Greene 2 Brady 3 Skidbury 4). In a fairly recent contribution to this subject Warwick (5) important summary of a necropsy report on hæmorrhage in the newborn is as follows:

1 "Cerebral hæmorrhage of the newborn is frequently found occurring in 50 per cent of the 36 fatal cases of young infants at the University Hospital.

2 The condition is brought about by trauma in normal or rapid deliveries, by congestion or asphyxiation in slow deliveries, or by disease of the child itself.

3 Hæmorrhagic disease of the newborn is a very important cause of cerebral hæmorrhage in infants occurring in 44 per cent of the deaths in our series.

In our series of 100 consecutive deliveries there was only one case which the pediatrician clinically diagnosed as hæmorrhagic disease of the newborn. This happened in a luetic child with a 4 plus Wassermann reaction who began to have hæmatemesis and melæna on the second day and died within the next 24 hours. Two lumbar punctures, one 12 hours and the other 36 hours after birth, revealed clear spinal fluid under normal pressure. The coagulation time was 45½ minutes done on the first day of life. Rodda (6) however states that the coagulation time usually begins to lengthen on the third day of life though it may begin at the sixth hour. At postmortem examination intracranial hæmorrhage was absent.

4 Forcep deliveries advanced age of the primipara mothers and syphilis probably do not play as important a rôle in the etiology of this condition as was formerly supposed.

In a still more recent article Huenekens (7) makes the emphatic statement that the recognition of cerebral hæmorrhage of the newborn is a most neglected phase of the care of the newborn while it is a most important one.

Sharpe and Lopejo (8) in a series of lumbar punctures on 100 consecutive newborn babies within the first 48 hours ascertained intracranial hæmorrhage in 9 per cent. All these occurred in normal or so-called normal deliveries.

## PATHOLOGY

The size of the extravasation of blood may be small or large varying in amount from 1 dram to 2 ounces or more. The small hæmorrhages may be single or multiple and they are usually all subdural and subarachnoid anatomically. In addition to being supracortical the large hæmorrhages may also occur intraventricularly. Cerebral oedema often accompanies intracranial hæmorrhage. Uncomplicated extradural hæmorrhage is rarely seen. To quote Holt (1) "Extradural hæmorrhage may be said never to occur except when associated with fracture."

The very small and signless hæmorrhages are rarely sufficient to cause death and may in our opinion be absorbed by the natural processes without producing any resultant defect in the child's future normality. Holt (1) on the other hand claims that even small hæmorrhages usually cause some permanent injury though this may not be manifested for years. Other hæmorrhages may be of such a size as not to cure death, yet after absorption of the blood, do leave behind them an organization residue coating the supracortical vessels and especially the veins which constitute approximately 80 per cent of the normal channels of excretion of

the spinal fluid. The resulting situation would necessarily produce an external hydrocephalus of varying degree followed in the future by some secondary cerebral impairment or spastic condition or both. If the organized tissue sealed the foramina of Magendie and Luschka then in addition to the external an internal hydrocephalus would be produced.

These cases eventually grow up to be known as Little's disease though cerebral spastic paralysis may be caused by cerebral agenesis and meningoencephalitis. Little (9) in 1843 stated that cerebral hæmorrhage in the production of cerebral spastic paralysis was the factor in only a few instances. Nineteen years later (1862) he (10) placed the figures of hæmorrhage as the cause to be as high as 75 per cent. Spastic paralysis whether it is of the diplegic, paraplegic, or hemiplegic type caused by intracranial hæmorrhage at birth should be excluded from the group of true Little's disease the latter should include only the agenic and meningoencephalitic forms for the reason that the intracranial hæmorrhage cases are amenable to drainage if seen early enough in the initial stage.

#### SYMPTOMATOLOGY

The cases are brought to the neurologists or neurosurgeons late when the mothers notice that their children fail to sit up or walk teething is delayed mental impairment is present paralysis is manifest, or some such obvious sign is present. If we are more fortunate, the cases are seen early. However in such instances the conditions are severe enough to produce extreme stupor cyanosis repeated convulsions, spastic paralysis opisthotonus, bulging anterior fontanelle and the separation of sutures. As a rule the hæmorrhage is of necessity large in these cases. The more common situation which is for the most part overlooked and permitted to remain undiagnosed, are the extremely mild cases wherein slight drowsiness, apathy few muscular twitches, failure to nurse properly and feeble or irregular respirations constitute the clinical picture or even these in the mildest cases may be entirely wanting. Holt (1) states that cerebral hæmorrhages are fre-

quently found when there have been no signs referable to the brain and that it is a question whether they are not quite a common sequel of labor. Holt is aware of the frequency of the condition and he belongs to the minority group

#### OCCURRENCE

With this in mind this present investigation was carried on as a continuance of the first series of 100 cases to determine if possible what percentage of newborn babies sustain intracranial hæmorrhage and cerebral oedema, with or without signs and whether a routine method could be adopted whereby cerebral vascular injury without signs could be detected early. This investigation will be continued until a larger series has been studied and under the same existing conditions.

Permission was obtained to continue this line of research on the maternity division at the City Hospital, Welfare Island through the courtesy of Drs F A Dorman and Wilbur Ward.

Routine lumbar punctures were performed on the second 100 consecutive newborn babies, ranging in age from 9 minutes to 100 hours. The intention was to do all these punctures within the first 24 to 48 hours and only in 7 cases were the babies older. In one of these a 53 hour old baby was bloody spinal fluid present. The 2 infants one 9 and the other 14 minutes old, had clear spinal fluids the former had an intracranial pressure of 12 millimeters mercury and the latter a pressure of 4 millimeters mercury. The normal intracranial pressure as registered by the spinal mercurial manometer at lumbar puncture is 4 to 8 millimeters mercury. It is, however advisable to delay performing this test until 22 hours after birth to permit the child to adapt itself to the new environment and to adjust its mechanism to its new surroundings.

The technique consisted of the following: an intramuscular hypodermic needle was used instead of the regular lumbar puncture needle. The spinal puncture was done in the fourth lumbar interspace. The child's back was well flexed by a nurse. After the needle entered the spinal canal and spinal fluid was obtained the child was relaxed from its strained position and as a rule ceased crying.



With the child quiet the intraspinal manometric reading was taken. If blood tinged or bloody spinal fluid was obtained another puncture one space higher was made. If the second puncture performed immediately after the first was clear, then the tap was considered a clear one. If however the character of the fluid was the same as in the puncture below then that index was taken. To consider a fluid blood tinged or bloody the spinal fluid had to be well mixed with blood and not blood-streaked, also several cubic centimeters of fluid of the same consistency had to be removed. Twenty four hours later a second drainage tap was performed. In the bloody cases and in those with cerebral edema the former for the purpose of removing the hemorrhage and in the latter to reduce the edema and the intracranial pressure. In the bloody cases the spinal fluid obtained on the second puncture varied in concentration of blood from straw to cherry red depending upon the character of the spinal fluid and the quantity of hemorrhage present in the first puncture. As a rule the spinal fluid appeared clearer at each successive lumbar puncture. The third drainage puncture was performed 48 hours after the first puncture and the spinal fluid continued to show either a diminution in the blood concentration or a return to the normal colorless spinal fluid proving that the hemorrhage had been entirely drained. Some of course was absorbed. If three punctures failed to suffice to drain the hemorrhage as many more were performed at 24 hour intervals as were necessary to procure clear spinal fluid. The test tubes containing the bloody fluid were left to stand for 30 minutes to determine the presence or absence of coagulation. Bloody spinal fluid does not clot readily whereas pure blood does. In this manner an intravenous puncture of the spinal plexus of veins was differentiated from true bloody spinal fluid. In addition in questionable cases it is always possible to resort to the Benedict test for sugar the latter being constantly present in the normal spinal fluid in sufficient amount to give the reaction whereas the reduction in the blood is not found.

## FINDINGS

In 13 cases of 100 consecutive newborn babies, bloody spinal fluid of varying degree was found. The fluid ranged in color from straw (in a 37 hour old baby) to bright cherry red.

In the blood tinged or bloody spinal fluid, repeated lumbar punctures every 24 hours were performed until the fluid was clear. In only 3 cases was this not accomplished. One case a medium forceps, the second of a pair of twins, at the first puncture had a manometric reading of 8 millimeters mercury. Six cubic centimeters of bloody spinal fluid was removed the first day. Four more punctures were performed at 24 hour intervals and only 1 or 2 cubic centimeters was obtained at each tap. The pressure was not taken at the subsequent taps, and the child left the hospital with the spinal fluid still blood tinged. The second case was the child of a 4 plus syphilitic woman who had been in labor 5 days and finally delivered as a breech. The initial spinal pressure was 6 millimeters mercury. 5 cubic centimeters of bloody spinal fluid was removed the first day. Two more taps were made 24 and 48 hours later when only a few drops of bloody fluid escaped. This case also never had a clear fluid during its hospital residence. The third case was that of a face presentation. The first manometric reading was 4 millimeters mercury. Only 1 cubic centimeter of bloody fluid was obtained on lumbar puncture. Another puncture 36 hours later yielded a few drops of spinal fluid which was less bloody than the initial tap showing that absorption had well progressed. The hemorrhage probably was extremely small in this latter case. The second case showed twitches of the hands and the third case had twitches of the face, mouth, hands and feet also cyanosis of the face. The twitches ceased after the initial tap in the second case and on the fourth day in the third case.

In four cases, one puncture was sufficient to drain the hemorrhage in that the second puncture was clear. In two cases two punctures were required. In one case three punctures were necessary. In another four punctures were performed and in still another five

TABLE I—ONE HUNDRED CASES—CONSECUTIVE DELIVERIES

	Cases	Total
Males	55	
Females	45	100
Premature	5	
Multiparae	49	100
Clear spinal fluid	8	
Blood tinged or bloody	5	
Casuals not entered	86	100

punctures. One case, that of a 7 month pre-mature baby weighing 2 pounds and 12 ounces was punctured 15 minutes after death its fluid was blood tinged. The autopsy was delayed several days and careful examination of the brain was not obtained.

The intracranial pressure in the 13 bloody cases ranged from 4 to 26 millimeters mercury and was as follows: 4 millimeters mercury in five cases, 6 millimeters mercury in one case, 8 millimeters mercury in three cases, 10 millimeters mercury in two cases, 12 millimeters mercury in one case and 26 millimeters mercury in another. The blood-clotting time was estimated in 9 within the first 24 hours, 2 between 24 and 48 hours, 1 at 53 hours of life and one 15 minutes after death and in these 13 cases it was as follows: 7 minutes in 1 case, 7½ minutes in 2 cases and in the other 10 cases, the time ranged between 4 to 6½ minutes, the normal being 5 to 8 minutes. In one of these cases, the mother had a 4 plus blood Wassermann reaction, while the child's umbilical cord Wassermann was negative. In another the mother had a 1 plus blood Wassermann and the child was negative. Of these 13 bloody cases 6 were normal cephalic deliveries, 3 prolonged labors, 2 of which terminated as cephalic presentations, and 1 as a breech; 2 medium forcep deliveries, one of them the second of a pair of twins, one a face presentation and one the child of an eclamptic mother. The anterior fontanelle in these 13 bloody cases was flush in 7 cases, bulging in 3, depressed in 1 and not recorded in 2. The anterior fontanelle was in no way indicative of the spinal pressure obtained. Only two of these babies had the mildest of signs, namely twitchings of the face, hands or feet and cyanosis of the face. None of the marked signs such as convulsions, stupor, spasticity, failure to nurse etc. were present.

TABLE II—THIRTEEN BLOODY CASES

No.	Name	Age	Character of spinal fluid	Spinal fluid pressure in millimeters mercury	Clotting time	% of post-natal
	I D	37 h	Straw	4	4 min	1
	J C	30 h	Blood tinged	4	6 min	
3	P C	50 h	Blood tinged	4	none	done
4	M L	9 h	Blood tinged	4	7 min	
5	S T H	3½ h	Bloody	26	4 min	3
6	R N	5½ h	Bloody		7 min	
7	N E	5½ h	Bloody		8 min	5
8	H K	35½ h	Bloody	8	6½ min	2
9	P T	4 h	Bloody	8	7½ min	5
1	A G	6 h	Bloody		5 min	
	W B	5 h	Bloody	6	7½ min	3
	A B	h	Bloody	4	5½ min	
1	A I	h	Bloody	8	4½ min	5

Left hospital—fluid not clear

Eight were first borns, 3 the second and the seventh and the twelfth. Twelve were males and 1 was a female.

#### OTHER OBSERVATIONS

One baby was jaundiced and died. The spinal fluid was clear and the coagulation time was 7 minutes, determined 14½ hours after birth. The necropsy failed to include the cranium. Another case, which was a medium forceps delivery had bloody spinal fluid and developed jaundice on the third day with a temperature of 102 degrees F. The blood clotting time lengthened from 4½ minutes to 6 minutes. Four lumbar punctures were necessary to obtain clear spinal fluid. Further study must be made of the relationship if any between intracranial hemorrhage and jaundice and the allied icteroid conditions, whether the absorption of hæmoglobin of an intracranial hemorrhage can produce the clinical picture of a mild degree of icterus has not been definitely proven.

Ten babies of this series were of luetic mothers, 2 of them had an intracranial hemorrhage while in the remaining 8 the spinal fluid was clear. Of these luetic children the intracranial pressure was normal in 7, in one it was 10 millimeters mercury and in two it was 12 and 14 millimeters mercury.

TABLE III—FORCEPS CASES

	Low Forceps	Medium Forceps
Number of cases	8	6
Clear spinal fluid		
Bloody or blood tinged		
Canal not entered		

TABLE IV—BABIES OF SYPHILITIC MOTHERS

	Cases	Total
Clear spinal fluid	8	
Bloody or blood tinged spinal fluid		
Normal spinal pressure	7	
Increased spinal pressure	5	10

respectively. Signs of twitchings, refusal to nurse or difficulty in suckling and cyanosis were exhibited in 8 cases, of these one had a spinal pressure of 14 millimeters mercury five were normal and in two the punctures were not successful due probably to faulty technique or to anatomical variations of the spinous processes or of the bony canal itself. Ordinarily a "dry tap" occurs only in cases of pyogenic meningitis where the pus is too thick to flow out through the needle and where the trap door of the dura formed by the entering needle may clog the lumen. Cerebral edema of varying degree without hemorrhage or signs as determined by the spinal manometer was present in 16 cases. The mothers of two children had an active gonorrhea. One of the former had a doubtful Wassermann reaction (1 plus) and that mother's child had bloody spinal fluid. This series contained 51 primiparae. Fifty five of the babies were males. No untoward signs developed as a result of the puncture in this series.

Let us digress a moment to narrate a case seen in private consultation and which left a marked impression upon us as well as to cause us to modify the original outline of treatment.

The writers were called one afternoon August 28, 1923, to see a patient delivered by Dr. S. Swift. The case was a very difficult forceps delivery and the baby weighed 9.5 pounds. The right parietal region was flattened while the left corresponding side gave evidence of a cephalhematoma. That same afternoon a lumbar puncture was performed the baby being then 5½ hours old. Shock was present as indicated by the slight cyanosis, the cold skin and slightly labored

TABLE V—CHARACTER OF SPINAL FLUID IN CASES OF PROLONGED LABOR

	Cases	Total
Bloody spinal fluid	3	
Clear spinal fluid		
Canal not entered		6

TABLE VI—CHILDREN WITH SIGNS AND THE RELATIONSHIP OF THE ANTERIOR FONTANELLE AND SPINAL PRESSURE

	Cases	Total
Twitches of hands, legs, face and mouth, cyanosis, poor nursing—7 cases		
Bloody spinal fluid		
Clear spinal fluid	4	
Canal not entered		7
Anterior Fontanelle		
Balging		
Flask	3	
Depressed		
Not recorded		7
Spinal Fluid Pressure		
Normal	5	
Increased		
Not noted		7

TABLE VII—FACE PRESENTATION CASES AND THEIR SPINAL FLUID

	Cases	Total
Bloody spinal fluid		
Clear spinal fluid		
Canal not entered		3

respirations. A lumbar puncture revealed bloody spinal fluid under a pressure of only 3 millimeters mercury and 5 cubic centimeters was withdrawn. Three hours later the child died (8½ hours after birth). That same evening an autopsy was performed a hemorrhage of approximately 12 ounces was found within the scalp tissues on the left side a fracture depression of the entire right parietal bone was present and all the cerebral sulci contained bright red blood. No large supracortical clot was observed. The ventricles were clear.

The fact that the condition of shock in this child became worse following the lumbar puncture at which the bloody spinal fluid was ascertained under a pressure of only 3 millimeters mercury would tend to indicate that in cases of shock, just as in adults having acute brain injuries no examinations, manipulations, or special tests should be performed until the acute stage of shock has subsided for fear of increasing the shock, thereby lessening the patient's chances for recovery for life.

There were 10 forceps deliveries of these 8 were low forceps and in 7 the spinal fluid was clear and one canal was not entered two were medium forceps cases both of which had bloody spinal fluids

#### ETIOLOGY

In these cases of intracranial hæmorrhage where the labor apparently has been normal, where extraneous factors such as forceps or pituitrin (the latter was not used in any case in this series) were absent, in fact where the physician played a minor or secondary part in the delivery, it seems that the most important etiological factor in the production of cerebral vascular trauma may be attributed to rupture of the supratentorial venous tributaries as they enter the sinuses whether due primarily to the overriding of the cranial bones caused by the tremendous pressure to which the head is subjected in the normal process of molding or to an extreme congestion and dilatation of the supratentorial veins.

Hæmorrhagic disease of the newborn probably does not play so much importance as a factor in the etiology as formerly believed. It is interesting to note that the coagulation time is ordinarily found lengthened only upon and after the third day although it rarely may be present as early as the sixth hour. In these series the clotting time has been estimated within 24 to 48 hours after birth and thereby explains the fact that in no case of intracranial hæmorrhage of the newborn was the coagulation time prolonged. In this series, one case clinically diagnosed as hæmorrhagic disease in the newborn did not have an intracranial hæmorrhage and the other 12 cases having bloody fluids did not have the disease.

Forceps as a factor becomes more important where the application is a late difficult one or where it is a medium or especially a high rather than a low forceps.

#### TREATMENT

Holt (1) advises surgical intervention early as he doubts the value of lumbar punctures.

Our experience in these cases can be summarized by the following if death from an intracranial hæmorrhage occurs on the first

or second day the blood is found partly fluid and partly clotted this early clotting of the blood may be entirely postmortem or may occur during the moribund period since cranial operations as late as the fifth day after birth have revealed no clotting of the intracranial hæmorrhage. If death occurs on the fourth or fifth day the blood may be entirely coagulated and may begin to undergo partial absorption. Therefore if lumbar punctures are performed before the blood has had an opportunity to begin to clot, the repeated spinal drainage will draw off a certain amount of blood at each tapping the quantity remaining will mix with the additional new cerebrospinal fluid secreted and the blood dilution will be increased. This will tend to prevent coagulation. If however after repeated lumbar punctures the blood concentration of the spinal fluid shows no tendency to diminish then we firmly believe that a modification of the subtemporal decompression and cranial drainage as described by Cushing is indicated in order to prevent impairment of the child's future normal development. The early use of calcium lactate or blood serum to aid in lessening the amount of the intracranial hæmorrhage may be of use. An important point always to be remembered is not to perform any tests whatsoever if the infant is in shock. This fact cannot be too strongly emphasized. Cases that are in shock should be treated as one of us (12) has outlined for the acute traumatic brain injuries in adults. Therefore, in these cases of intracranial hæmorrhage in the newborn in the presence of shock, recovery from shock is of primary importance the spinal drainage of repeated lumbar punctures may then be used and if that fails then a modified subtemporal decompression and cranial drainage.

#### SUMMARY

As intracranial hæmorrhage in the newborn occurs more frequently than formerly believed every child evincing the mildest signs of cerebral irritation, or of increased intracranial pressure, should be subjected to a lumbar puncture. The performance of a lumbar puncture in experienced hands is a

safe procedure and the child does not suffer any ill effects from it with the one exception stated above with the child being in severe shock. In addition, the bloody cerebrospinal fluid at birth is in a fluid state so that it can be easily drained by repeated lumbar taps, and the more major procedure of a modified subtemporal decompression relegated to those cases wherein lumbar drainage fails and in this manner the institution of early therapy will tend to prevent many pitiful and helpless cases of cerebral spastic paralysis.<sup>1</sup>

#### CONCLUSIONS

1 Intracranial hemorrhage of the newborn occurs more often than formerly suspected

2 Death results from extensive intracranial hemorrhages and cerebral edema unless the hemorrhage can be entirely absorbed by the natural means of excretion without any resultant organization residue the unrecognized and therefore improperly treated cases of the milder degree of intracranial hemorrhage develop in a large percentage later some form of cerebral spastic paralysis with or without mental impairment

3 Cerebral spastic paralysis due to intracranial hemorrhage should be differentiated from Little's disease—the latter including only those cases due to cerebral agenesis and meningitis encephalitis

4 Pediatricians, neurologists, and neurosurgeons usually see the cases late as chronic conditions when spastic paralysis in its various forms has already developed and when the condition at best can only be improved whereas it is the obstetrician who sees these cases in the acute stage

5 The acute cases with mild signs or no recognized signs at all are overlooked

6 A study was undertaken to detect apparently signless intracranial hemorrhage in the newborn with the result that 13 per cent of 100 consecutive deliveries at the City Hospital were discovered as having an intracranial hemorrhage of varying degree by routine lumbar puncture within the first 24 to 48 hours after birth

<sup>1</sup> It is most advisable and our intention to examine these patients having had an intracranial hemorrhage at the time of birth at frequent intervals over a period of years

7 Low forceps and syphilis were not found to be important factors in the causation of intracranial hemorrhage at birth

8. Lessened coagulability of the blood does not appear to be an important and frequent factor in intracranial hemorrhage of the newborn—the clotting time not being lengthened in any of the cases in this series within 48 hours after birth.

9. Lumbar puncture as a diagnostic and therapeutic measure has proven to be a safe procedure in this series in the absence of shock

10. Apparent signs indicative of an acute intracranial hemorrhage and cerebral edema can be confirmed or disproven by early lumbar puncture and the resulting intracranial pressure estimated with the spinal meningeal manometer and in doubtful cases the appropriate treatment instituted early

11. Lumbar puncture is advocated as a safe routine procedure in suspected cases having the mildest signs of intracranial hemorrhage and cerebral edema within 72 hours after birth and is a valuable aid to the natural means of their absorption.

12. Repeated spinal drainage by means of lumbar puncture at intervals of 6 to 24 hours is advocated in cases of bloody spinal fluid under varying degrees of pressure.

13. If repeated lumbar drainage fails to diminish progressively the blood concentration and the pressure of the cerebrospinal fluid then a modified subtemporal decompression and cranial drainage is indicated

14. The fact that an intracranial hemorrhage occurred in 9 per cent in the first series of 100 consecutive deliveries and in 13 per cent in the second series of 100 would tend to indicate a more frequent intracranial lesion at the time at birth than ever conceived

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## A SYMPOSIUM ON PAIN

THE SURGICAL SIGNIFICANCE OF PAIN<sup>1</sup>

BY WILLIAM D. HAGGARD, M.D., F.A.C.S., NASHVILLE

"There is purpose in pain,  
 Otherwise it were devilish

—OWEN MEREDITH

PAIN is the chief defense mechanism against injury. It apprises us of many diseased states and accidents. It has been spoken of as the language of disease but it is often particularly meager many times greatly involved frequently misleading and sometimes perplexingly silent. Pain in some regions is easily recognized as characteristic of definite pathological processes. It is oftentimes bizarre and mixed with many conflicting manifestations. Moreover it is so greatly modified by the individual as to be deceptive. The hypersensitive type of individual will endure severe pain with little outcry. A highly neurotic subject becomes an amplifier. Ordinary pain in them is increased to the nth power and makes them the subject of the surgeon's greatest solicitude. The phlegmatic are notoriously uncomplaining. The stoic minimizes pain that is of serious import. The neuropath in acute lesions suffers great agony and in chronic disease though he may not suffer his family suffers.

The cerebrospinal system, a later addition to the nervous system, is the real outpost against injury. The vegetative nervous system which has to do with the primitive processes presides over these essential functions and at times conveys pain in an exaggerated way during the normal events of digestion and elimination. If harmful afferent stimuli pass to the cord over a long period of time the threshold of response of the nerve cells which receive these stimuli is necessarily lowered and they respond to a stimulus which is much below that which they would ordinarily withstand. Hyperirritability of these cells permits a lesser stimulus than normal to produce a heightened response.

A patient whose sympathetic system is out of tune and who has so-called nervous indigestion will complain more bitterly than one who has a real pathological entity like an ulcer of the stomach. The triad of hunger pain, food ease and night pain, relieved by vomiting or alkalis, made Moynihan say that the diagnosis of duodenal ulcer could be made by correspondence. While nothing is more telltale than the explosive upper abdominal pain that goes through to the back in gall stone colic, at the same time a considerable proportion of cases of gall bladder disease do not have this frank manifestation. Subscapular pain is referred by the way of the sympathetic through its connection with the fifth or sixth dorsal nerve.

The complications of most diseases obscure the initial pain, but fortunately tenderness, rigidity and temperature complete the syndrome of infection. Acute perforation of the hollow viscera is manifested by primary sharp, stabbing abdominal pain quickly followed by the excruciating pain of intense peritonitis.

Acute perforation of the stomach and duodenum is frequently attended with colic, followed by localization of the infectious material in the right iliac fossa, so frequently that perhaps one-third of the cases of perforation of the duodenum are diagnosed as appendicitis.

The complication of gall stones when the pancreas is infected is denoted by the most severe abdominal pain associated with vomiting and collapse followed in 24 hours by an elastic, fluctuant, epigastric tumor. At first it is often regarded as acute intestinal obstruction to be later recognized as acute hemorrhagic pancreatitis, the most dramatic catastrophe in the abdomen.

The well known epigastric pain of appendicitis, localizing itself in the right iliac fossa

<sup>1</sup> Reprinted with the symposium on pain presented before the Clinical Congress of the American College of Surgeons, Chicago, October 1-6, 1933.

is very uniform and familiar when the appendix is in its usual position to the inner side of the cecum. The symptoms are usually so frank that the diagnosis is easily made. When the appendix is behind the caecum, the mild unreferred pain will not challenge recognition and will allow grave suppuration to supervene before it is detected.

Perhaps the most deceptive pain in the abdomen to the surgeon is abdominal pain in children with beginning pneumonia where the diaphragmatic pleura is involved and mimics appendicitis. This should cause the clinician to be constantly on the alert for this dissimulation and make the wary examine the chest with great assiduity.

The very severe pain in the trajectory of the lower dorsal nerves extending around the right costal arch may in herpes zoster simulate a mild cholecystitis and the true cause will be discerned only when the vesicular pattern appears on the third or fourth day.

We have learned to look upon abdominal pain with such scrutiny and realize so well its portent that I have seen a diagnosis of intestinal obstruction made from the pain and allied symptoms alone when the inguinal hernia that was the cause of the obstruction had never been observed. While pain is a striking symptom requiring interpretation it is the collateral symptoms that clinch the diagnosis. We must not ignore the cramp-like spasmodic and persistent periumbilical pain of intestinal obstruction. If it occurs after abdominal section even though the patient is still in the hospital one should think of adhesive bands causing obstruction. Reoperation is less dangerous than a purgative. Who can differentiate the pain of mesenteric thrombosis from intestinal obstruction? The court of immediate appeal is exploration.

The whole subject of pain must be considered from the neurologic standpoint and is the most fascinating study. From the classical relentless pain of the *douloureux* to the plebeian painful heel the immense network of sensory nerves ramifying to every area associated with every function and distressed by every dysfunction weaves a tangled

web. Only by knowledge of the nervous distribution can one correctly interpret the occult origin of pain. Witness the referred pain to the inner side of the knee along the branch of the obturator nerve in hip joint disease in children.

After all it is the relative significance of pain that we must take into account. Disaster follows on our lack of interpretation of its importance. Excruciating pain in the shaft near the diaphysis of one of the long bones in a child in connection with chill and high fever imperatively calls for the recognition of acute osteomyelitis. It is murderously disguised as rheumatism and, if not correctly interpreted and promptly treated by early evacuation, acute bone abscess occurs and long continued reparation for the bone destruction and sequestration of debris delays its weary length. The general symptoms are so alarming and overwhelming that no time should be lost in giving vent to the infection in order to prevent widespread death of the medulla. In such urgent circumstances the bone must be opened immediately even if you have to use a gimlet. This statement will be recognized as the plea of that greatest of American teachers of surgery John B. Murphy.

Pains in the abdomen are not all due to visceral disease. Tuberculosis of the spine with pressure on one of the spinal nerves can give such pain over the distribution to the abdominal wall as to delude the unskilled observer. The abdomen has been opened for the unilateral referred pain from a carious spine that only required a well fitting brace.

One must think in atypical abdominal cases of the gastric crises of tabes dorsalis, of plumbism, of the abdominal anginal attacks in arteriosclerosis.

Pain is a monster that may be so insistent as to compel our greatest interest and yet it may be a gay deceiver. We have learned to be so suspicious of the pain complained of by the neurotic that occasionally their cry of woe is unheeded. The usual pitfall is mortifyingly in the other direction. The constant burning pain over the right iliac fossa that has been diagnosed chronic appendicitis and operated upon elsewhere, often

comes to you with the selfsame pain unrelieved. By their scars ye shall know them. A case that has never had a bona fide acute attack should make us counsel the patient to get relief of the pain by other than surgical measures. We have it upon very highest authority that there is no closed season for the neurasthenic. They are as sheep in wolves clothing and even deceive that good shepherd the family physician.

Pain in these unfortunates may depend upon an abnormal personality rather than an organic abnormality. They need a physician who can raze out the written trouble of the soul.

He is the best surgeon who is able not only unerringly to recognize the surgical significance of pain but who also will clairvoyantly divine the significance of non-surgical pain.

## PAIN ASSOCIATED WITH SURGICAL LESIONS OF THE EYE<sup>1</sup>

By JAMES M. PATTON, M.D., F.A.C.S., CHICAGO

**A**LTHOUGH the failure to recognize the significance of pain secondary to surgical lesions of the eye may only in very rare cases result in the death of the patient, there are numerous cases where the pain is so severe and far removed from the involved eye and the general symptoms so prostrating that the vision of one or both eyes may be irrecoverably lost before either the surgeons or patient awakes to the fact that the eye is the source of the trouble.

This is especially true in acute inflammatory glaucoma. In the majority of cases the diagnosis is easy enough. The patient is well aware that the eye is exquisitely tender and that the severe neuralgic headache is directly associated with the ocular condition but every oculist of experience has seen cases where the attack is ushered in by a most severe prostrating neuralgic sick headache. Nausea and vomiting may be a prominent symptom with or without severe epigastric pain. The patient is glad to lay perfectly quiet with the eyes closed not even suspecting that they are the source of the trouble. Any case of otherwise unexplained neuralgic headache with or without gastric symptoms should suggest the possibility of an acute glaucoma.

Pain of a similar character though less severe associated with a blind eye, especially of long standing may indicate the presence of an intra ocular tumor and if the oculist cannot definitely rule it out the general surgeon first suspecting the condition should lend his moral support on the side of enucleation. A

sudden pain in or about the eye during the course of pneumonia, typhoid fever etc should at once suggest the possibility of a beginning metastatic panophthalmitis. Here again the symptoms may be masked and as the progress is often very rapid an early grave prognosis is indicated.

A beginning iritis or iridocyclitis may be mistaken for a simple conjunctivitis and much valuable time and even useful vision lost unless the surgeon remembers that the head ache of which the patient complains radiating over the side of the head and worse in the after part of the night, is most suggestive of iritis. If on palpation he finds a zone of tenderness just back of the cornea he can feel sure that the ciliary body is also involved. Pain on rotating the eyeballs usually means an inflammation of Tenon's capsule and indicates a prompt search for some focus of infection. A retrobulbar inflammation of the optic nerve may be painless but a rapid decrease of sight associated with deep pain back of the eye should suggest this condition or possibly a deeply seated orbital tumor although this condition can usually be recognized by the displacement of the orbital contents. The pain of an orbital abscess is more severe than either of the above but of the same character usually associated with more or less general prostration. Corneal infections may cause pain out of proportion to the appearance of the lesion. Here again the pain is radiating in character but there is usually sufficient local discomfort to call attention to the area involved.



The headaches and eye aches resulting from errors of refraction and muscle unbalance are as a rule easily recognized from the history although they may be so severe at times as to be quite incapacitating and demand prompt recognition and relief. Two forms of pain from this source may be misleading viz deep cramping aches at the back of the neck and between the shoulder blades, the result of faulty posture, and the severe often one-sided headaches associated with so-called scintillating scotoma, both calling for careful attention to refraction and muscles.

In conclusion let us remember that a severe

neuralgic headache with or without nausea should suggest the possibility of acute glaucoma that the pain of iritis is worse in the second half of the night, that sudden pain in one eye during the course of a general septic process may mean a destructive panophthalmitis that pain in or about an old blind eye is an intra-ocular sarcoma unless proved otherwise and that even though the pains indicating the lesser lesions mentioned may not indicate such grave conditions, they are worthy of recognition by the general surgeon and his prompt intelligent advice will entitle him to the heartfelt gratitude of his patient.

## INTRACRANIAL PAIN<sup>1</sup>

By JOHN F. BARNHILL, M.D. F.A.C.S. INDIANAPOLIS, INDIANA  
Professor of Surgery of the Elmer and Mack Enders University School of Medicine

**I**NTRACRANIAL pain is common. It may be but a mild toxic headache or an unendurable pain of meningitis. It may be a severe intermittent pain due to brain tumor or the constant, bursting pain of an infectious exudate. It may be so mild that the individual pursues his task, or so severe that he seeks a darkened apartment, buries his head in the pillows and shrieks aloud from intolerable suffering. It may be but an inconvenience resulting from indiscretion in diet or it may be so severe as to clearly indicate impending death.

Pain anywhere probably is always caused by absorption of toxic products by sensory nerves or by their traumatism. Usually both these causes are active at the same time. This pain may be due to pressure, to infection, or to pressure plus infection. Environment has much to do with the ease with which pressure pain is produced. In regions where loose tissues prevail, as in the neck, the pressure of a growing tumor or of an exudate, pushes the sensitive nerves aside, and pain is delayed. Inside the cranium conditions are different. No structure within the skull may be pushed aside without causing definite traumatism and positive pain. The encephylon is covered by the meninges, the dura of which is almost wholly inelastic. It is further encased by the

skull which provides absolute resistance to expansion. Increased intracranial contents will, therefore, mash and traumatize all structures against the hard and non resistant inner table of the skull.

The dura mater because of its position next the skull is the part most easily traumatized by intracranial pressure. It is also the only intracranial tissue that is to any degree endowed with sensation. The brain itself is wholly without sensation. The pia mater has but few sensory nerves, while the arachnoid is wholly insensitive. In the dura mater therefore, all intracranial pain originates. The actual cause of the pain often lies in the deeper structures of the brain, but the influence of that cause must in some way reach the dura mater before pain may be produced. Intracranial pain, it would seem, is always in the end an affection of the dura mater. The dura is the sensory organ of the brain.

*What pathological conditions and diseases are foremost in the causation of such pain?* The contents of the skull cavity are normally sterile. So long as this sterility is maintained, intracranial pain may not occur. The physiological status of the brain is disturbed chiefly by the entrance from without of infection or the products of infection. The healthy brain is menaced by this invasion from two sources,

namely through the blood stream and by direct entrance through the skull itself. The blood stream carries disease, or the products of disease from distant foci of infection. Direct invasion of the intracranial contents may result from injuries but more often from necrosis of bone due to suppuration in one or more of the numerous sinuses or cells which lie between the tables of the skull, and which are in direct communication with the nose and ears, which frequently are mere containers of sepsis.

Intracranial pain, therefore is due usually to a definite assignable cause and may often be traced to some external clearly understandable source. Its extrinsic origin is certain and usually definable. The paranasal sinuses and the mastoid cellular labyrinth are the commonest foci of origin. From these paranasal sinuses and mastoid cells, which in many individuals are so numerous and large as to surround great areas of the brain infection products, often present their way through the thin inner table of the skull and directly invade its sterile contents. Or the intercommunicating blood stream may carry the infection from the septic cell to the sterile brain. The result is the same in either case. Inflammation is set up inflammatory products are formed intracranial pressure is increased the sensitive dura mater is crushed against the skull and intolerable pain is produced.

1 *Tic douloureux*. One disease, *tic douloureux*, which probably causes intracranial pain although such pain is commonly recorded externally is an affection of the gasserian ganglion and has no definite pathology. Possibly *tic douloureux* should not be classified as a disease giving rise to intracranial pain. It certainly has not been proven that it is the result of infection. It is however becoming increasingly clear that the real pathology whatever it may be is oftenest in the ganglion and that the external pain of it is but a reflex. Clinical experience in dealing surgically with the disease, leads to the conclusion that both the disease and its terrifying pain are in reality inside the skull.

2 *The circulation in the brain of toxic substance in the blood*. A long list of acute and chronic general diseases are responsible for this

type of intracranial pain. Common headaches often severe and recurrent, reducing health to the point of invalidism are due to this cause. Toxins arising from indigestion or constipation circulate in the blood stream of the brain and poison, temporarily the sensitive dural nerves. No doubt transitory exudates occur simultaneously and thus both toxicity and pressure act together as a cause of pain. Migraine, worst of periodic headaches should probably be placed in this class of ephemeral toxic headaches. Meningitis, typhoid fever measles, small pox, and crsipelas head the list of acute diseases. All these may be heralded and accompanied by intolerable headache. The toxin is absorbed by the sensory dural nerves and the increased blood supply plus the accompanying exudates traumatize the dura by crushing it against its osseous capsule. Among the chronic diseases of this class Bright's disease and glycosuria are best examples. The circulation of syphilitic poisons in the brain may cause headache in the earlier stages, but later exudates and tumors of luetic origin are chief factors in the pain production and the same may be said of early and late tuberculosis.

3 *Tumors of whatever kind and cause as gummatous tubercular gliomatous cancerous etc*. The severity of the pain may be out of proportion to the size of the tumor. Its location may have much to do with the amount of suffering. A small tumor which obstructs the interventricular circulation may produce more pain than a tumor many times its size but placed differently. The amount of brain displacement and consequently the degree of intracranial pressure is more the cause of the pain than is the nature of the tumor itself. Thus the fact that a gumma is large is more reason for pain production than that it is of syphilitic origin. For the same reason a brain abscess causes pain, not so much because it is an abscess as that because of its size it crushes and traumatizes the sensitive dura mater. Other symptoms may be present which will differentiate a brain tumor from a brain abscess, but pain of similar character and severity is apt to be the same in both. Intracranial pain is a symptom of first importance in both brain tumor and brain abscess. Pain

choked disk and vomiting are the most constant symptoms of brain tumor and brain abscess, and of these the one most often present is pain severe, torturing and more or less constant.

Intracranial pain is undoubtedly less frequent today than formerly. It has to no inconsiderable extent been prevented or conquered by modern medical and surgical science. The military and laboratory expert working together has discovered the cause and nature of blood stream infections acting on the brain to cause pain and have in several paths to-

ducing diseases notably in syphilis and diabetes robbed these diseases of their most terrifying symptoms. Surgery also has added greatly to the relief of intracranial pain when due to tumor growths or fluid collections. The splendid technique of Jellison of the Royal College of Surgeons of England, and the equally brilliant work which is being advanced by Flowers of the American College who are specializing in brain surgery will be fair to claim in the near future a yet greater abatement of intracranial suffering by means of surgical measures.

## PAIN IN THE EAR

WILKINSON, UZMAN, HAN, MITCHELL, NEW YORK

WHEN a patient comes to us complaining of pain in the ear, it is important to know whether the pain is due to a lesion about the ear or is a reflex pain due to a lesion in some other part of the body causing this phenomenon. Much suffering is prevented if care is used in determining the cause of the pain for operative measures about the ear in a patient suffering from reflex pain would only make the condition worse and until the original focus of trouble is properly taken care of no permanent relief can be expected. As we all know pain is one of the most common symptoms of pathological conditions arising directly in the external middle or internal portions of the ear. From the infective process in any of these portions of the ear come the more grave complications that arise in ear work to relieve which requires at times very extensive surgery of the mastoid sinuses and intracranial structures.

To diagnose early and locate the cause of pain in the ear is of prime importance as nearly all pain about the ear proper is from pressure. relieve this pressure institute adequate drainage and fortunately the majority of the acute ear cases complaining of pain promptly recover. Not to do this causes untold discomfort and adds a dangerous factor by causing extension of the trouble to structures adjacent to the ear which when involved increase enormously the danger to

life and prolong the period of suffering with its extra expense and loss both from the business and from other standpoints. It is of interest to note the different names patients and otologists use in describing the pain associated with ear lesions. For example we have pain described as "dull aching" "agonizing" "boring" "throb-like" "throbbing" "darting," etc. each meaning to either patient or doctor much as regard the type of the condition likely to be met.

In contradistinction to pain in other parts of the human body it has long been known to the layman that as to the intense pain there is called earache is associated with danger and for this reason we fortunately see our ear cases in early stages.

Several factors enter into the degree of pain either experienced or found on examination: first the patient, second the type of infection and third the structure of bone whether soft or pneumatic or the bony structure seen not uncommonly.

We all know a certain type of patient greatly exaggerates any symptom while the opposite type seen not infrequently make little of any illness and we marvel at times how the latter have stood the pain when examination reveals the advanced condition. I was once hurriedly called to the hospital to see a man, whom his family doctor told me he had seen the night before and realizing the serious con-

dition present insisted that he go to a hospital. He did not consent until the next morning and when I saw him in the emergency room he was semiconscious, both ears discharging while pressure over either mastoid would rouse him for a few minutes. He was operated upon for a double mastoid. After making the incision and starting to use my periosteal elevator I noted that the bone would move under my instrument. I stopped and raised the flap with dissection and with my thumb forceps took out a sequestrum that represented a good portion of the temporal bone. The mastoid on the opposite side showed extensive necrosis but not the same picture. He was not expected to recover but he did so and when asked why he deferred seeking relief told me he did not mind the pain.

Another case seen in a comatose state died while I was endeavoring to stimulate and improve her condition which did not justify attempting a mastoid operation. Death occurred within an hour after entering the hospital. When the mother was asked why she allowed the daughter to progress to such an extreme condition she replied that the fear of the hospital was the only reason yet the pain and suffering must have been intensely severe. Further inquiry as to any basis for such fear of a hospital revealed nothing. The antipode of this extreme is the other type, the one who complains of intense pain when a speculum is put in the ear for routine examination, no inflammatory condition being present. A marked difference is here you will all agree with me. Yet both types are found, I know many times by those doing ear work. In estimating the value to be placed on the degree of pain, consider your patient. It will be of untold value to you in many instances. We often when examining the ear should place value on the facial expression showing real distress rather than fear. The type of infection seems to change the amount of pain to a marked degree. In cases with marked destruction of tissue from a streptococcus capsulatus infection the pain may be mild or altogether absent the same holds true with many of the tuberculous type. The third element entering into cause of pain structure of bone will be spoken of later.

Pain can aid us in our diagnosis and when properly interpreted holds a prominent place in our regular routine in all ear work. If in the examination the patient endeavors to move away when the auricle is touched if pain be constant or worse when the mouth is opened or closed the lesion is in the external canal and we shall be safe in making a diagnosis of acute otitis externa. Cases of acute otitis externa that are not seen early may cause a good deal of swelling over the mastoid area with the usual signs of mastoiditis and we should carefully examine the canal and drum membrane in all.

If no pain is noticed when the finger is pressed over the mastoid but pain is present upon pressure up and inward under the lobe of the ear the pain worse at night and in the recumbent position the trouble is in the middle ear and will be verified by further examination of tympanic membrane.

Mastoid pains vary with the character of bone which is being dealt with. The pneumatic and eburny type will each have special symptoms. In the soft pneumatic bone pain on pressure will be great but the patient will complain very little as pus has found an easy passage toward the cortex. In the eburny type the patient complains of much pain and pressure will not reveal it even until later in the course of the disease. No matter what the history or symptoms as a regular procedure in all inflammations about the ear test out carefully for any of the painful points with which you are all familiar in the mastoid region especially note the area over antrum and tip. Do not consider your examination made unless you have considered these two as a regular duty. There is still another type of pain about the mastoid extremely troublesome when found painful on pressure. The patient complains of severe distress as in an ordinary mastoid infection yet examination of the canal and middle ear shows no true ear involvement. We have here an otalgia to deal with and the foci of infection must be looked for in the tonsils teeth or other parts of the body. A mastoid operation is unnecessary. With a history of pain followed with or without discharge from the ear with a marked rise of temperature, 104-105 degrees

dropping to nearly normal in a short time thus to be repeated in 24 hours, we must consider a possible sinus thrombosis.

A case with headache and vomiting and a history of previous ear discharge with or without pain directly in the ear should warn us of a likely intracranial complication, meningitis especially. Pain is one of the early symptoms of brain abscess and we should remember that

the site of pain is no guide to the location of the abscess, occipital pain being present in many cases of temporosphenoidal abscess while frontal pain is found in cerebellar involvement. Aphasia if present would aid us in locating the abscess in the left side. In all these infections associated with deafness, vertigo, nausea, and nystagmus, examine the labyrinth for cause of your trouble.

## PAIN IN THE JOINTS AND BACK<sup>1</sup>

By R. D. KENNEDY, M.D., F.A.C.S., GLOWE, ARIZONA

WHEN I was asked to speak on the subject of pain in the back and joints, I came to the conclusion that the committee must have been studying Arizona's compensation laws. Because of our inadequate compensation laws, I know of no other place where pain, especially in the back, can be and often is so highly capitalized. As pain is a subjective symptom and is caused by such a variety of lesions, in order to properly interpret it, we must avail ourselves of all the information we can acquire leading up to its cause. This information is gained through a careful and painstaking history noting particularly previous illness, mode of onset of the present attack, duration and the noticeable symptoms.

Next will come the physical examination. In all cases in which pain in the back is the chief complaint, the patient should be stripped, and his general condition noted—any deviation from normal in the contour of the spine, tenderness over the spinous processes, and any evidence of muscular spasm. The patient should be made to put the spine through the full range of motion, and any limitation or increase of pain on any of the movements noted. Proper X-ray pictures should be taken, and any other laboratory facility employed which will help us to a better understanding of our case.

Cases with pain in the back may be divided as to cause into several groups: those due to injury; those due to arthritis; those due to traumatic neurosis; those due to new-growths; those due to uterine, pelvic, or abdominal

disorders; those due to postural or mechanical strain; and those due to a myositis of the muscles of the back.

Traumatic backache may be divided into cases of fractures and sprains. It is as a rule, no trouble to diagnose serious fractures, but it is possible to diagnose many minor fractures only by the X-ray, as fractures of the laminae, spinous or transverse processes, as a rule, cause no deformity and are frequently overlooked. All these cases should be X-rayed in the lateral and anteroposterior direction.

I have seen cases where one or more of the lateral processes of the lumbar vertebrae were broken in which the patient lost no time from his work, while others with apparently a much less severe injury of the same character would be away from work for months, or until a settlement was made.

Simple sprains of the spine are common and the symptoms vary according to the degree of injury or the site. Usually a history of a blow, torsion, or sudden and unusual muscular stress can be elicited. They are most common in the cervical and lumbar regions. The onset is sudden, and the pain is increased by certain movements which put the injured parts on a stretch. In the lumbar region, the pain may radiate downward into the thighs and buttocks, and even into the calves of the legs. The X-ray is negative.

Where compensation is involved, this kind of case is often difficult to treat as many of them refuse to get well until settlement is made. The pain due to adhesions is usually

located in the region of the seventh cervical or dorsolumbar junction, and over the fifth lumbar vertebra and sacrum. In the absence of arthritis or other demonstrable cause this should always be borne in mind.

Arthritis of the spine occurs either primarily in the spine or in connection with a general arthritis. The onset may be insidious or abrupt. There is a gradually increasing stiffness of the spine with pain radiating forward along the ribs and downward into the buttock. When the involvement is in the lumbar region, the lumbar curve is flattened, the muscles are held tense and movements of this portion of the spine are painful. When the dorsal region is involved rotation becomes restricted and chest expansion diminished. The pain is increased by jars, and there is a gradually increasing kyphosis.

Altitudinal strains are a cause of a high percentage of backaches and are due to a faulty deflection of body weight causing constant strain to spinal joints ligaments and muscles. The causes are most often the shortening of a leg flat foot, shortened posterior muscles in the leg or a very large abdomen.

The deviation may be either lateral or anteroposterior. If it is in the lateral direction the pain is usually unilateral and is most often in the lower half of the spine. It is more frequent in women than in men. It is aggravated by standing and relieved by sitting. The pain is most often on the convex side of the curve. In cases of some standing, there is a shortening of the tissues on the concave side and a consequent limitation of motion in the opposite direction. If the deflection is in the anteroposterior direction, the pain is as a rule, associated with standing, walking sitting or lying down. It may be located in any part of the spine but is most often in the lower half. The pain is a dull dragging one. The patient is relieved by having the physiological lumbar curve supported. The pain may be unilateral or bilateral and is frequently

located over the region of the sacro-iliac joint where tenderness may be elicited. These are often diagnosed as sacro-iliac strains. The X-ray shows no displacement.

Abnormally long transverse processes of the fifth lumbar vertebra are often a cause of pain in the back. When the extremity of such an elongated process comes in contact with the base of the sacrum during lateral flexion an irritation is set up causing a localized outgrowth of bone to develop from the sacrum with the formation of a bursa or false joint. If the condition is unilateral the pain is relieved by bending in the opposite direction.

In some cases the transverse process of the fifth lumbar vertebra fuses not only with the sacrum but also with the ilium. This condition combined with an osteo-arthritis of the sacrolumbar joint may result in the reduction of the size of the intervertebral foramen which transmits the anterior division of the fifth lumbar nerve, producing pressure on the nerve, and pain. The fourth sacral nerve which descends in front of the lumbosacral transverse articulation may also be pressed on causing pain along the course. The X-ray will show many cases of sacralization of one or both processes causing no symptoms.

Following railroad accidents, being buried by a fall of dirt or other similar accidents, pain in the back is often complained of without demonstrable lesions in either the spine or cord. The pain is usually not well localized and is often of a radiating character. It may be accompanied by partial or complete rigidity of the spine. There may be areas of anesthesia or hyperesthesia. The pain often increases some time after the accident instead of improving as expected and is associated with great depression. Patients become irritable, sleepless, and are unable to concentrate. In some cases there may be functional paresis with loss of control of the bladder and rectum.

PAIN ASSOCIATED WITH GYNECOLOGICAL AFFECTIONS<sup>1</sup>

By RICHARD R. SMITH, M.D. F.A.C.S. GRANT RAPIDS, MINNESOTA

IN dealing with so large a subject in so brief a space of time many general statements are necessary and such are apt to be unsafe since the director may readily find instances to disprove them. I trust you will bear this in mind in reading this article. Certain general conceptions as to pain in gynecological affections are valuable however in giving us a lead, though they seldom establish the final diagnosis.

Pain arising from lesions in the pelvis is located in the lower abdomen, the groins, the external genitalia, the uterus, and vagina, and less often in the rectum and sacrum. There is very little tendency to radiate, as compared for example with that arising from obstructed biliary or urinary passages. When it does it extends down the thighs or upward toward the diaphragm and loins. It seldom leaves any doubt as to its origin. Such radiation when it does occur may sometimes be taken as a sign of severity or of unusual sensitiveness.

Gynecological affections seldom give rise to backache. When they do, the pain is more apt to be in the sacrum than in the lumbar region. The cause of the common lumbar backache of women is to be sought in fatigue, in faulty posture and occasionally in arthritis, and not in the pelvis. Headaches of all descriptions, and pain in remote parts of the body are not caused by gynecological affections. Such remote pains and backache are frequently associated with pelvic difficulties, but not caused by them, and it is imprudent to promise their relief by surgical or other gynecological measures. The old time so called "refer pains" are a matter of historical interest only.

Simple ovarian tumors do not cause pain but there may be discomfort when they reach a large size. Pain occurs only when there are complications, such as twisting of the pedicle or infection and inflammation about the tumor involving the peritoneum. Likewise fibroid tumors do not as a rule cause pain until they reach a large size when they may do so for mechanical reasons. Its cause, when

present, is commonly found in some complication, such as infection and necrosis in the degenerative process of such tumors. We are dealing here however with a muscular organ subject to painful contractions in the effort to expel. Uterine tumors, especially intra-uterine ones, may thus cause intermittent pain. There is a type of fibroid uterus—a small uterus with many fibroids—which is tender and painful the cause being not readily apparent.

Malignant tumors of the ovary seldom cause pain or discomfort until they are far advanced and until there is a large amount of ascites. Cancer of the cervix and uterine body in its early stages is unfortunately not painful. Its presence is a sign of advanced disease.

Simple retroversions cause no pain and for that matter no other disturbance. Extreme flexion occasionally causes discomfort. It is often present when there is subinvolution or other uterine pathology increasing the size of the body. An incarcerated uterus usually gives rise to much pain. A uterus fixed in retroversion by adhesions, with the attendant disease of the appendages, is often painful.

As to prolapse, even a moderate degree may cause discomfort when the patient is up and about, and an extreme degree almost always does so sooner or later. The attendant cystocele and rectocele, especially the former add materially to this discomfort.

Acute salpingitis causes moderately severe pain compared with other acute abdominal infections. In infections going out from the uterus or tubes, pain means an involvement of the peritoneum though the peritonitis may be well circumscribed.

The acute pain of a ruptured ectopic pregnancy is one of the severest with which the gynecologist has to deal. It is at first usually general in character later located in the lower abdomen and in one or the other groin. The tube from which the hemorrhage has occurred may thus be safely surmised, though there is an occasional exception. Pain in the rectum

from the filling of the cul-de-sac with blood is a very common symptom and may be used to strengthen a diagnosis, since its occurrence in other pelvic conditions is not so frequent.

Simple lacerations of the cervix do not cause pain. When attended by induration and inflammation there is sometimes an indefinite discomfort in the pelvis. It is rather remarkable that a badly lacerated undurated discharging cervix causes so little discomfort.

Old lacerations of the perineum cause no pain, but an accompanying rectocele may give rise to discomfort. Most of the disturbance from the lacerations of childbirth come from a consequent cystocele. A urethrocele or eversion of the sensitive mucosa of the urethra—conditions which are often overlooked when an examination is made with the patient relaxed and in a prone position—sometimes gives rise to marked soreness and discomfort.

Dysmenorrhea may occur in patients with a uterus apparently sound as well as in patients with the so-called underdeveloped uterus. Its direct cause is spasm of the uterine musculature and the disturbance is a functional rather than an organic one.

Painful affections of the vulva need no mention in so brief a paper.

We have mentioned pain in its relation to those lesions of the female genitalia the correction of which is the peculiar function of the gynecologist. Often, however, we find pain when so far as we are able to determine the organs are normal or present lesions that should not be painful. The pain, so far as the

location goes, simulates very closely that attending real lesions of painful nature. There is nothing that requires greater diagnostic skill on the part of the gynecologist than the accurate estimating of the physical condition of the pelvic organs and the part that the nervous system is taking in the symptomatology.

The term *neurosis* is almost as general as the term *disease*, so varied are its manifestations. We must bear in mind first that we are dealing with sensitive functioning organs and not inert ones. Our conception of what constitutes a *neurosis* may vary greatly. Gynecologists are not neurologists nor are most of them profound in their knowledge of neurological literature, but in a general way it may be said that two principal factors enter into the production of pain in the nervous neurotic woman. The first is an over-sensitiveness of the patient, so that organs ordinarily functioning painlessly now do so painfully. The second factor lies in the mind of the individual, whose faulty conceptions as to the integrity of her sex organs and the attending anxiety in regard to them exaggerate normal sensations into those of pain or discomfort. There are almost always other manifestations of the neurotic condition. We are dealing then with a functional disturbance of the nervous system, of which pain in the pelvic region is but a symptom. The success of the gynecologist in his particular field of endeavor will depend largely upon a rational understanding of such situations and his determination to refrain from instituting surgical measures.



PAIN DUE TO PATHOLOGICAL CONDITIONS OF THE GENITO-URINARY TRACT<sup>1</sup>

B. A. J. CROWELL, M.D. F.A.C.S. CHARLOTTE, NORTH CAROLINA

**K**IDNEY pain is due to some stimulation of the sensory nerve supply of the kidney. Severe kidney pain is the result of some acute process and is divided into the inflammatory and non-inflammatory types. The inflammatory type is constant, aching in character, increased by palpation and percussion while the non-inflammatory type is more sudden in onset, more severe and paroxysmal in character and disappears more suddenly than that due to inflammation. The patient lies on the opposite side to prevent pain in inflammatory conditions and on the affected side when pain is due to kinked ureter in nephroptosis, or any non-inflammatory condition causing sudden ureteral occlusion. Inflammatory kidney pain is increased more by deep breathing than by motion. That caused by kidney congestion is better in the morning and worse in the evening. The latter is not eased by fixation and is sensitive to deep pressure.

Pain in the kidney region associated with local tenderness signifies kidney involvement. Referred pain in kidney lesions is felt in the lower iliac and suprapubic regions and to the outer middle or inferior thigh. Pain in the penis, scrotum, perineum, inner aspect of the thigh, or lower sartorius indicates lower ureteral involvement. If felt in the latter areas in renal colic with increased frequency of urination, without pain during the act, the stone is nearing the bladder. In high ureteral involvement the skin of the scrotum is not painful to pressure but the deep tissues are.

Probably 50 per cent of right-sided pain is due to kidney lesions. In movable kidney pain is increased by standing and relieved by lying down. Tension of the renal vessels in Dietl's crises increases intracapsular pressure and causes kidney soreness for some time following the attack.

Renal infarction pain is sudden in onset, burning in character, free from paroxysms, and does not radiate into the inguinal region

or the genitalia. It is increased by motion and relieved by reclining on the affected side.

The pain in perinephritis is severe and located in the lumbar region. If the lumbar plexus of nerves is involved the pain is referred to the knee and lower thigh, and especially so if the abscess is located at the lower pole of the kidney. If the abscess is at the upper pole, the intercostal nerves are involved and the pain is referred to the area of their distribution. If the pain and tenderness are sharply limited and associated with edema the infection is perinephritic. In suppurating conditions of the kidney pressure in front causes considerable pain while in perinephritic abscess the tenderness is greater in the back.

Severe pain in the kidney region following trauma when accompanied by hematuria means rupture of the kidney. If paroxysmal in type it signifies that the rupture has extended into the kidney pelvis.

Pain is present in the terminal stages of tuberculosis of the kidney. It is increased by pressure on the anterior wall, the para-umbilical, subcostal, and lumbar regions. It is associated with frequency of urination and occurs before and after voiding. In far advanced cases, ureteral colic is produced by the passage of blood or pieces of necrotic tissue.

Pain is present in about 75 per cent of the cases of pyelitis. It radiates from back to thigh, perineum and genitalia or upward to the epigastrium and shoulder. Upper ureter involvement causes pain similar to that of diseased kidney. Pain in the kidney zone prior to its presence in the ureteral zone means kidney lesion. Kidney zone pain persists after the ureteral obstruction has been removed while the ureteral zone pain disappears spontaneously.

A renal calculus without infection does not produce pain unless blocking of the ureter occurs. The pain is due to increased intra-

capsular tension. If the capsule is thickened and non-elastic when subjected to pressure the pain is severe. It is constant when accompanied with pelvic infection and paroxysmal when the stone is too large to enter the ureter and is so located as to have a ball valve action. When occlusion occurs the pain is sudden in onset and relief is unilateral and radiates to crest of ilium anterior abdominal wall, groin and testicle on the same side, and occasionally extends down leg to toe. It is relieved by pressure and aggravated by motion.

In ureteral calculus, the pain is present in both the kidney and ureteral zones. Distention of the ureter itself has something to do with the production of pain. Changing position of pain as the stone moves down the ureter is clinical evidence of this fact. Pain due to complete ureteral obstruction gradually becomes less marked and disappears unless complicated by kidney infection. This is due to the progressive decrease and final inhibition of the urinary secretion.

Spasm of the ureter will produce an acute hydronephrosis and paroxysmal pain. The same kind of pain will result from occlusion of the ureter with calculus, blood clot, detritus, stenoses of the ureter or ureteritis. When the ureter is inflamed, pain is elicited at the brim of the pelvis by deep palpation and by rectal or vaginal examination.

Bladder lesions produce both frequent and painful urination when the lesions are located in the trigone otherwise they are practically painless. The trigone is the only part of the bladder which is extremely sensitive. A vesical calculus will produce agonizing pain at the end of urination especially if associated with trigonitis. If the bladder is adherent to the rectum or sigmoid bowel action will produce urinary tenesmus and bladder pain. Adhesions to the uterus and tubes will produce severe pain during menstruation pregnancy and sexual intercourse.

Bladder pain is of two types constant and paroxysmal. The constant type is felt behind the symphysis and indicates a severe inflammation which extends into the muscular walls of the bladder. Paroxysmal pain occurs just before and at the end of urination. Bladder lesions causing pain are vesico-urethral fissures, cystitis, pericystitis, tuberculous, tumors, calculus, distention and rupture of the bladder. Pain due to ruptured bladder is severe and is located in the lower abdomen. It is sudden in onset, and follows trauma. The desire to urinate is constant but not relieved by attempts to void.

Tumors of the bladder cause pain by obstructing the ureter and distending the renal pelvis or by blocking the urethra and producing retention of urine.

PAIN IN THE UPPER ABDOMEN AND CHEST<sup>1</sup>

By CHARLES H. PIERCE, M.D., F.A.C.S., NEW YORK CITY

PAIN in the upper abdomen or chest as the initial or outstanding symptom is common to many pathological conditions not always easy to differentiate.

The first consideration should be to determine whether the condition is medical and amenable to proper medical treatment, or whether the pain indicates the onset of some serious surgical condition which may demand prompt operative relief. Until the latter possibility is safely excluded the administration of morphine or sedatives which may mask important symptoms and obscure the diagnosis should be avoided.

A number of non-surgical conditions may cause upper abdominal pain as simple gastric indigestion with which most of us have had personal experience, food or ptomaine poisoning or the ingestion of poisonous drugs or substances.

Pain referred to the upper abdomen may be caused by: (1) Conditions within the chest or about the diaphragm as pleurisy, pneumonia, pulmonary infarct or abscess, thoracic aneurysm, mediastinal inflammation or neoplasms, angina pectoris, and the pain of venous congestion of the liver and abdominal veins in cardiac decompensation; the pain of a perihepatitis, which I have seen caused by the rough nodules of a liver carcinoma projecting on the convex surface against the diaphragm. I was called to a distant city in consultation on such a case, the cause of the obscure persistent pain having been unrecognized. (2) Pylorospasm and the condition known as writhing duodenum. I removed the gall bladder in a case of the latter malady and later another surgeon performed duodenojejunotomy but the duodenum still writhes, according to the radiologist and the patient, a well known physician and old personal friend who had had medical and diagnostic advice from many expert sources. (3) The gastric crises of tabes for which I have seen gastro-enterotomy performed. (4) Peripheral nerve pains due to spinal nerve root pressure to local

neuralgia or neuritis, to the early stages of herpes zoster.

Turning to surgical causes of upper abdominal pain operative or non-operative, lesions of the biliary tract deserve first consideration. Four general types of pain cover most of the cases.

Type 1. Typical biliary colic, severe, intermittent with complete freedom from pain in the intervals. Irregular in time of occurrence with occasional slight jaundice after the attack.

Type 2. Acute gall-bladder distention with occlusion of the cystic duct, constant, severe, increasing pain and local tenderness, often with fever and leucocytosis. Some cases go on to acute cholecystitis, abscess formation, rupture of the gall-bladder or gangrene.

Type 3. Chronic variable pain with gaseous indigestion without jaundice or fever which may last for years before the gall bladder is suspected. We meet with many such cases.

Type 4. The classical picture of stone in the common bile duct with intermittent pain, fever, chills and jaundice.

Gall-bladder pain is generally to the right of the mid line at the costal margin. It radiates to the back, right shoulder blade and shoulder or across the abdomen to the left. It may be maximal in the mid line or quite atypical in location. I have recently removed a gall bladder full of calculi in a woman who, for 3 years, had had acute attacks of upper abdominal pain always referred to the left costal margin with no local tenderness. Several excellent diagnosticians had considered the pain of neurotic origin.

Pancreatitis should be considered in close relation to biliary tract disease with which it is usually associated. Sometimes the extension of pain and tenderness to the left or the greater severity of the symptoms make a pre-operative diagnosis possible. More often the clinical picture is merged with that of the gall bladder. In the acute hemorrhagic or gangrenous type the violence of onset and course

may simulate acute perforated ulcer or mesenteric thrombosis. The disease may be of any degree of severity ranging down to moderate swelling discovered in the course of upper abdominal operations. Pancreatic calculi are rare.

Many cases of upper abdominal pain have their source at a distance. Appendicitis, acute and chronic, is the most frequent offender. Epigastric pain at the onset is so common as to be the rule in many acute cases. Pain in chronic cases is often referred to the stomach. Appendicitis is a frequent cause of chronic digestive disturbances which closely simulate those of ulcer and of so-called pylorospasm. High retrocolic appendices, when diseased, cause pain closely simulating that of gall-bladder disease or of right kidney lesions. I have removed an acute perforated appendix where for 7 years previously repeated attacks of pain had been persistently located high up to the left near the splenic region. The long appendix ran upward to the left its tip across the mid line pointing toward the spleen. A number of expert diagnosticians on both sides of the Atlantic had repeatedly failed to recognize the cause of the pain attributing it to a neurosis. The attacks never recurred after removal of the appendix. Pain of appendix origin can simulate almost every known abdominal lesion and must be included in nearly every table of differential diagnosis.

Gastric and duodenal ulcer with their classical syndromes and also their many atypical manifestations form a group about which pages could be written. The scope of this paper will not permit of a careful differential study of pain types and their pathological bases. It must suffice to say that peptic ulcer whether of the chronic indurated type, the sub-acute acute or chronic perforating types, is one of the most frequent and important causes of upper abdominal pain. Gastrojejunal or marginal ulcer following gastroenterostomy causes severe and persistent upper abdominal pain. The pain of acute perforating ulcer is often intense agony associated with shock.

Pain due to lesions of either kidney is usually located in the lumbar region and radiates downward to bladder genitals or thigh

It may however in acute infections, especially of the unilateral hematogenous type, cause pain referred to the upper abdomen. If this fact is borne in mind and other clinical symptoms and signs are correlated diagnostic errors should rarely occur.

Subphrenic abscess, liver abscess, and perinephritic abscess must all be included among the conditions to be considered. I have observed and reported a case of acute hepatitis, with swelling of the liver, recent fibrinous exudate and a hemorrhagic serous exudate explored as acute appendicitis with recovery and subsidence of the condition, which was probably an acute infection entering through the portal system. Thrombosis or phlebitis of the portal vein as a cause of upper abdominal pain, I have met with once at operation performed for supposed subacute perforation of a duodenal ulcer. The portal vein and its two hepatic subdivisions were hard cords, there was ecchymosis and some exudate in the adjacent retroperitoneum, but no general ascites. The patient, a physician and personal friend is perfectly well 8 years after operation.

I have recently seen a case diagnosed as septic thrombus of the portal vein, but unverified by operation or autopsy go from acute onset to fatal termination in 3 days, the temperature repeatedly above 106 and once reaching 108.8 degrees.

Thrombosis of the mesenteric vessels, one of the acute abdominal tragedies, is often heralded by upper abdominal pain. I have recently explored a case within 8 hours of onset with gangrene of the entire length of small intestine. Thrombosis of mesenteric branches with localized gangrene may occasionally be amenable to surgical relief.

Enlargement of the retroperitoneal glands due to tuberculosis, Hodgkin's disease, sarcoma or metastatic growths, may cause upper abdominal pain, though it more often centers lower down. Malignant disease of the stomach, liver, gall bladder or ducts, pancreas, or colon, is a common cause of upper abdominal pain. Peritoneal adhesions in the region of gall bladder, duodenum, or stomach post-inflammatory or postoperative are a fruitful source of upper abdominal pain of variable

type and severity. To attempt a study of the symptoms and diagnosis of these conditions is quite beyond the scope of this paper.

Small epigastric hernie in the mid line above the navel are not uncommon causes of pain, and the rarer subdiaphragmatic hernie and internal hernie in the Fossa of Treitz, must occasionally be reckoned with.

Aneurism of the abdominal aorta or its branches may cause severe pain from pressure or erosion of vertebrae or acute pain from rupture. Osteomyelitis or neoplasm of vertebrae or ribs, including metastatic disease, must also be remembered.

I have discussed only the conditions which I have had the opportunity to observe personally and have undoubtedly omitted many important causes of upper abdominal pain, emphasizing naturally perhaps surgical more than medical etiology.

One might well think that 30 years' experi-

ence in active hospital practice in acute surgery should make the reading of upper abdominal painful conditions an open book, but I must confess that it is seldom that a week does not bring its puzzles in diagnosis and errors in interpretation. Upper abdominal pain must never be taken lightly or casually. Many cases are due to lesions which call for prompt surgical intervention. Many when first seen by the surgeon, are masked by the previous administration of narcotics.

On the other hand surgical intervention without proper pre-operative study and diagnosis on the plea of exploration, may mean unnecessary operation for some trifling non-surgical condition and should not be tolerated.

In the last analysis common sense and a broad knowledge of both medical and surgical conditions which may cause upper abdominal pain will protect both patient and surgeon against such errors.

## DIABETES INSIPIDUS WITH ACUTE RETENTION IN PREGNANCY

## WITH REPORT OF A CASE

By D. M. VICKERS, A. B. M. D. CAMBRIDGE, NEW YORK  
 From the Surgical Service of the Mary McGehee Hospital

WHILE diabetes insipidus is not a rare condition, and is not infrequently seen in the larger clinics, the details of its etiology, possible complications, and treatment have not been thoroughly established. Each individual case should, therefore, be carefully studied. The combination of this, with the irritable bladder frequently seen with the enlarging uterus of pregnancy is something which seems not to be mentioned in the literature and makes the following case, with its resultant difficulties unusual enough to warrant reporting.

Historically symptomatic polyuria has been observed in ancient and medieval times and in 1670 Willis found that some of these unnes did not contain sugar. Near the end of the eighteenth century Cullen and P. Frank (1) definitely separated them into two classes, with and without sugar. Since then, observations have been accumulating and diabetes insipidus has been established as a clinical entity.

Clinically diabetes insipidus is the disease or syndrome characterized by the passage of a large amount (5 to 10 liters daily) of dilute urine (specific gravity 1.001 to 1.006) having no albumin or sugar. Total solids eliminated are normal. There is, of course, a correspondingly large intake. The primary cause does not lie in the kidneys, which at autopsy are found normal. But the mortality is low and autopsies are infrequent. Theoretically this polyuria is differentiated from a primary polydipsia with difficulty, but practically the distinction is usually clear. A chronic nephritis, interstitial or vascular in type frequently gives a large output but there is evidence of renal impairment, with lowered functional tests and elevation in the blood nitrogen. With true diabetes insipidus, there is (1) a possibility of concentration on a low intake, that is, the specific gravity is not absolutely fixed. (2) a possibility of concentration with pituitrin or with fever. (3)

an excessive polyuria after the ingestion of chlorides and (4) an absence of the theobromine effect.

Davis (1) found in 242 reported cases, that 75 per cent were in middle life between the ages of 5 and 40 and that there were twice as many males as females.

Weil (2) described a family of 219 members, 35 of whom had diabetes insipidus.

Herrick (3) in 1912 reported his much quoted case where the polyuria was stopped following a lumbar puncture with the removal of 5 cubic centimeters of fluid with a severe reaction.

Cushing and others (4, 5) in 1913 brought forward the influence of the hypophysis in this condition and suggested that the hypophyseal hormone ascended by the tuber cinereum to act on the proximal mesencephalic centers themselves.

Since that time, many more cases of diabetes insipidus have been observed to be associated with changes in nutrition and sexual development, unilateral or bilateral primary optic atrophy, deformity of the sella turcica shown by the X-ray and proven changes (tumor, glioma, etc.) of the pituitary body at operation or autopsy. In fact, the statement has been made (6) that there is no record of necropsy in which the pituitary was examined and found normal.

Recently however Bailey and Bremer (7) have brought forth evidence to show that experimentally a lesion in the para-infundibular region of the hypothalamus, with careful avoidance of injury to the pituitary body is followed by the characteristic polyuria.

Treatment has been largely symptomatic. Some cases have yielded to active antisyphilitic treatment, probably establishing this as their etiological factor. The quoted case of Herrick (3) has not been duplicated in the literature. Farrel (8) demonstrated that subcutaneous injections of pituitary extracts would temporarily control the disease. But Osler (9) as late as

his eighth edition does not mention pituitrin. This effect of pituitary extracts has been confirmed by many observers (6, 10, 11, 12, 13) and Blumgart (14) has since shown that the pituitrin can be given intranasally or in alcohol coated pills, (Rees 15) although when given directly by mouth it produces no effect.

The combination of pregnancy and diabetes insipidus is mentioned by French (16) who says that it may occur. The combination of the acute retention of pregnancy and diabetes insipidus is not mentioned in the available literature and is the unusual feature of the following case.

Recently acute retention in fevers, or post partum or postoperative, has been treated by Stater (17) with benayl-benzoate, theoretically to relieve the spastic condition of the vesical sphincter. The logic of its use has been confirmed experimentally in rabbits (18). Its use in this case was successful in relieving the retention, though it possibly was of importance in the abortion following.

The case is as follows:

An American housewife of 35 admitted complaining of lower abdominal pain. The family and past histories were essentially negative. There was no history of similar disease in any of the members of her family.

She has had no illnesses since the childhood diseases and the influenza in 1918. She habitually drinks large quantities of water, bucketful, as she expresses it, and passes large amounts of urine. She has had two normal deliveries in the hospital in the past three years and has never passed urine of a specific gravity higher than .003. At one time in her last pregnancy, she ran a slight temperature and a catheterized specimen of urine showed small amount of pus. After the administration of urotropine the temperature dropped and the urine cleared.

Her last regular catamenia was 3 months before admission and she had had some of the usual subjective symptoms of pregnancy. Four days before admission she began to have increased frequency of urination and lower abdominal pain. She was catheterized twice and large amounts obtained. She became increasingly uncomfortable and came to the hospital.

General physical examination at admission was practically negative. She was well developed and nourished. There was no limitation of the visual field and the optic discs were normal. The blood pressure was 90. Pelvic examination showed a normal introitus, normal urethral meatus, softened lacerated cervix, and fundus enlarged to the size

of a normal 3 months pregnancy in good position, freely movable. The adnexa were not felt. Catheterization was accomplished without difficulty and removed an ovoid tumor felt in the mid line, yielding 3, 50 cubic centimeters.

The leucocyte count was 4,000, with 40 per cent polymorphonuclears, 45 per cent small lymphocytes, 6 per cent red lymphocytes and 9 per cent transitional. The red cells were normal. The blood Wassermann was negative to both plates and cholesterolized antigen. The blood sugar was 1 milligram, and the blood urea nitrogen 1.8 milligrams in 100 cubic centimeters. The urine showed no sugar or albumin and varied in specific gravity between 1.003 and 1.006. The specific gravity of the blood was 1.065.

On a restricted intake, just consistent with bodily comfort and not sufficient wholly to satisfy the thirst, the output ranged between 3,000 and 3,500 cubic centimeters. For the first few days she was catheterized every 4 hours, voiding normally only in small amounts.

She was given 0.3 grams of benayl benzoate in capsules 10 times a day for a week and voided normally. This was discontinued and she required catheterization once, and being put back on the drug, resumed control of the sphincter. It was again discontinued, but 3 days later though voiding normally she developed lower abdominal cramps, began to flow and after few hours, discharged 3 months fetus. The fetus was normal in development and showed no stigmata or signs of disease.

After the abortion, she had no further retention although she continued to drink large amounts and to pass large quantities of urine.

X-ray showed slight anterior bending of the posterior iliac processes. Temperature, pulse, and respiration were normal. Weight, as constant.

On discharge, she was perfectly comfortable, with urine of specific gravity .004.

In this case, there was no general, focal, or neighborhood signs of disease of the pituitary. The administration of pituitum was considered but rejected for fear of inducing abortion. There was no local cause for the retention discovered except the pregnant uterus.

The urine at all times was low in specific gravity and the closest watch was necessary to prevent the patient from adding to her intake from unmeasured sources. With an output of 5 to 8 liters, she resorted frequently to washing her mouth with water to relieve the thirst.

The retention itself was controlled by the administration of benayl benzoate, but whether or not it relaxed the smooth muscle of the uterus, and thus was a factor in the production

of the abortion, is uncertain. The large intake and output of dilute urine continued after the abortion and seemed wholly unrelated to the pregnancy although there was no further retention following the termination of the pregnancy and the return of the uterus to normal size.

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## HERNIA THROUGH THE FORAMEN OF WINSLOW

B ALFRED ULLMAN, M.D., F.A.C.S., BALTIMORE, MARYLAND

Attending Surgeon, Harbor Hospital

INTESTINAL hernie through the foramen of Winslow are extremely rare only thirty cases verified either by operation or autopsy being found in the literature. They are as follows:

1 Blandin in his second edition of *Traité d'anatomie topographique ou anatomie des régions du corps humain* 1814 p 467 reports an unexpected finding at autopsy. Almost all the small intestines had passed into the lesser sac through the foramen of Winslow. Through an abnormal opening in the transverse mesocolon they had reentered the general abdominal cavity and had become strangulated in this abnormal orifice.

2 In Rokitsanski's *Handbuch der speciellen pathologischen Anatomie* 1842 iii 218 we find the statement "I once saw a large portion of the small intestine strangulated by the opening of the foramen of Winslow."

3 Treitz, under *Hernia retroperitonealis* in *ein Beitrag zur Geschichte innerer Hernien* Prag, 1857 p 126 gives a detailed description of an autopsy on a woman, aged 32 in which, among other abnormalities (absence of duodenum) two loops of jejunum were loosely caught in the foramen of Winslow the edges of which were thickened.

4 T Wilson Moor reports a case cited by Chiene in the *Journal of Anatomy and Physiology* 1868 ii 218 in which the patient had died of intestinal obstruction. At autopsy all the intestines were found to have passed into the lesser sac.

5 Novello in *Nel No 38 della Gazzetta medica delle provincie de Venete*, *Annuario delle scienze mediche dell'anno 1881* cites a case reported by Majoli. At autopsy a loop of small intestine was found to have passed through the foramen of Winslow as the result of abdominal pressure.

6 Majoli in *Rivista clinica di Bologna*, 1884 605 gives an interesting personal observation followed by autopsy the first case with clinical and anatomical data combined. A man, aged 42 after showing signs of obstruction died on the seventeenth day of his illness. At autopsy the transverse colon and part of the greater omentum were found in the lesser sac. It was not possible even at autopsy to reduce the hernia with simple traction. An incision of the edges of the foramen had to be performed before the release of the strangulation became possible.

7 Elliot Square in *Brit. M J* 1886 i 1163 mentions the case of a man, aged 20,



with acute excruciating pain in the epigastrium, associated with vomiting, who was seen on the third day of his illness. Tenderness was found in the epigastrium. There was no bowel movement for four days. He died on the third day after the onset of symptoms. Autopsy. The intestines were distended eight inches of ileum two feet from the cecum were incarcerated through the foramen of Winslow and were withdrawn with difficulty. The edges of the foramen were thickened and congested.

8 F Treves in Lancet, Lond 1888 ii, 701 gives what is apparently the first case reported of a laparotomy with a hernia through the foramen of Winslow. A man aged 26 developed symptoms three hours after a heavy meal. An operation for intestinal obstruction was done eight days after the onset of symptoms. Two or three feet of small intestine were reduced, but reduction of a second loop was impossible. It was not possible to enlarge the foramen without cutting the portal vein, hepatic artery and common duct. The patient died six hours later. Autopsy. The two or three feet of ileum that had been reduced looked purplish. The cecum, ascending colon and part of the transverse colon had passed through the foramen. At the splenic flexure there was a sharp kink which accounted for the distention beyond the strangulations. Some peritonitis was present.

9 Gangolphe. Lyon méd 1890, liv 607. A soldier aged 56 years showed signs of acute obstruction. Forty years previously he had had a similar attack of intestinal obstruction which had disappeared. At operation on the fourth day a certain resistance which gave easily was found and on the appearance of a loop of intestine, which was grooved the strangulation was believed to have been released. But at autopsy 3 days later 15 meters of ileum was found in the lesser sac. The intestines had perforated in places and fecal material lay free in the lesser sac.

10 Rehn Arch f klin. Chir. Berl 1892 xlvii, 310. A diagnosis of acute intestinal obstruction was made on a man aged 77. Laparotomy was performed on the third day of the illness. With firm traction a loop of

gut, 15 centimeters in length was withdrawn from behind the stomach. It presented evidences of obstruction but the intestine was in good condition. Death was probably due to an overdose of opium.

11 Neve, Arthur Lancet, Lond 1892, 1175. This is the first case of a cure after surgical intervention in a male (aged 17) with incomplete obstruction. Laparotomy was performed 28 days after the onset of symptoms. The hiatus, through which had penetrated part of the transverse colon, admitted two fingers. Other loops of intestine could not be withdrawn without tearing them. Traction failed. In spite of these findings the patient recovered.

12 Picado J S Revista de la Sociedad médica argentina, Buenos Aires, 1893, ii, 10. A soft tumor had appeared in the epigastrium of a boy aged 8 years, ten days before the onset of symptoms. Symptoms of acute obstruction developed. A laparotomy was done on the twenty-first day but the patient died. Autopsy. The distal end of the ileum was extracted with difficulty from the lesser sac. The ascending colon was invaginated into the transverse colon for 20 centimeters.

13 R. Stecchi Clin. chir., Milano 1894, ii 653. The case occurred in a male aged 63 years, with epigastric pain, distended abdomen, and vomiting. Enemata were ineffectual. A laparotomy was performed on the third day. The small intestines were distended, the large intestine flaccid, the foramen of Winslow was dilated sufficiently to admit the entire hand. The patient died on the third day after operation. Almost the entire small intestine was herniated into the lesser sac. The omentum was adherent to the inferior border of the foramen of Winslow producing the angulation of the transverse colon near the splenic flexure and thus causing the obstructive symptoms.

14. Reynier (Quoted by Jeanbrau and Riche). At an operation upon a patient, who was a *cretin*, there was found a hernia of small intestines through the foramen of Winslow. The gangrenous gut was reduced. Death occurred on the same day. No autopsy.

15 Mori, G. Gazz. med. lomb. Milano, 1898 vii 257. There were signs and a history

of acute obstruction in a man, aged 50. A laparotomy was done on the fifth day. The small intestines were distended. The caecum and ascending colon were not seen; the descending colon, sigmoid, and rectum were empty. By exclusion, the diagnosis of hernia through the foramen of Winslow was made. Reduction by traction was performed. The patient had a normal stool immediately after the operation.

16 Groves and Marten. *Indian Medical Record* 1901, xx, 333. There were signs of acute intestinal obstruction in a woman aged 47 years. Laparotomy was done on the fifth day. The transverse colon was engaged in the foramen of Winslow through which two fingers could be easily passed. The intestine was reduced easily by traction. An enterotomy for the relief of distention was done on the lesser bowel, and a caecostomy was also performed. A fecal fistula developed and closed later. The patient recovered.

17 DeKesakamp. *Beitr. z. klin. Chir.* 1905, xlvii, 644. The patient was a female, aged 22. Immediately after a normal labor she was taken with severe pains in the epigastrium. The abdomen became distended; vomiting occurred and no flatus or feces were passed. At operation, seven days after the onset of symptoms, 8 centimeters of ileum and almost the entire large intestine were seen passing through an opening which admitted three fingers. This was believed to be the foramen of Winslow. These intestines were covered with a peritoneal fold which proved to be the anterior sheet of the lesser sac. This was torn into some adhesions broken up and the herniated intestines drawn into the abdominal cavity. The patient was cured.

18 Jeanbrau and Riche. *Rev. de chir. Par.* 1906, xxxii, 618. The patient was a boy aged 6 with signs of acute intestinal obstruction, who was seen on the third day of his illness. An epigastric swelling was present. At a laparotomy the caecum, large intestine and part of the small intestines were found collapsed. The duodenum, jejunum and major part of the ileum were distended. The cause of obstruction was not determined but was believed to be strangulation through the foramen of Winslow. An enterostomy

was done for fear of tearing into the intestines. The patient developed symptoms of meningitis and died. No autopsy was obtained.

19 Rawitsch Schtscherbo. *X. Jahresh. f. Chir.* 1900, iii, 627. A diverticulum of the small intestines had passed through the foramen of Winslow. No operation was done but autopsy revealed the condition.

20 Adjaroff. (Quoted by Hilgenreine. *Prag. med. Wchnschr.* 1903, 571.) The small intestines were herniated through the foramen of Winslow. The patient died soon after operation.

21 Morton. *Charles A. Brit. Med. J.* 1909, i, 641. Immediately after defecation there occurred symptoms of acute intestinal obstruction. A laparotomy was done seven hours after the onset of symptoms. Intestinal loops were withdrawn from what corresponded to the foramen of Winslow. The small intestines were evacuated with a Paul tube which was sutured to the outside. There was leakage around the tube into the peritoneal cavity. Death occurred one week later from general peritonitis.

22 Cawardine. *Lancet, Lond.* 1909, ii, 1215. An engineer aged 44 was taken with violent abdominal cramps while he was telephoning. Vomiting of bile occurred two days later. Rigidity was present in the epigastric region. An operation was done on the second day after the onset of symptoms. The patient was almost pulseless. Some of the intestines were reduced but a vascular band prevented complete reduction. Gangrene was present. An enterostomy was performed. The patient died three hours later. An autopsy was obtained.

23 W. Haw. *Lancet, Lond.* 1909, i, 1598. A colored boy aged 5 was seen in a moribund state and died a half hour later. Autopsy. The caecum, appendix and part of the ileum had passed through the foramen of Winslow. Reduction of the hernia was impossible without dividing the edges of the orifice and in juring the vessels. The caecum and appendix were filled with worms.

24 E. Schwalbe. *Virchow's Arch. f. path. Anat. etc.*, 1904, cxcvii. This is a report of an autopsy. A woman, aged 34, died of parenchymatous nephritis and aortic and

mitral insufficiency The small intestines in the region of the duodenojejunal angle had passed into the lesser sac without being strangulated by the edges of the foramen of Winslow

25 Haymann Thesis, Munich, 1892. The patient, aged 20 with signs of pulmonary tuberculosis, was brought into the hospital The following day there developed symptoms of severe acute obstruction which suggested a high obstruction A laparotomy with median incision above and below the umbilicus was done The operator plunged his hand into the region of the duodenojejunal fossa and the hernia was immediately reduced It was thought that the intestines had herniated through the foramen of Winslow The patient died a quarter of an hour after intervention At autopsy the stomach was dilated pulmonary tuberculosis was present

26 Thomas Sinclair Brit M J 1909, 1 645 A man, aged 38 developed abdominal symptoms suggestive of acute intestinal obstruction Following a spell of coughing there was fever and an epigastric swelling A laparotomy was done on the third day A mid line incision above the umbilicus was employed The foramen of Winslow tightly constricted the intestine The edges of the orifice were dilated gently and 2½ feet of jejunum were then withdrawn with ease An annular constriction, almost gangrenous, was present This was fixed to the parietal wall and the free border of omentum was carried around it, so that, if rupture did occur it would take place into the omental sac No complications occurred and the patient was cured

27 Radovan Des hernies étranglées de travers de l'hiatus de Winslow 1919 Thèse de Paris A woman suddenly developed excruciating pain in the right iliac fossa For the first few days it was intermittent but later constant in character Very little vomiting occurred and feces and flatus passed Seven days after the onset, the condition of the patient became critical Just before that a tumor had appeared in the upper abdomen, and pain persisted in the right iliac fossa

An operation was done with a mid line incision above and below the umbilicus Below

the stomach there was a rounded mass under tension which suggested a lobulated cyst A flaccid loop of intestine, which lost itself in an orifice behind the hepatic pedicle, was picked up Passing out from this same orifice some dilated small intestine was seen It was impossible to reduce either loop by traction An incision was made through the transverse mesocolon and an enterotomy for the relief of distention and evacuation of the intestinal contents was done and closed up immediately After this, reduction became possible A great part of the transverse colon, all of the ascending colon, caecum and appendix and a small part of ileum were incarcerated in the lesser sac, and had formed the globular mass already described Cured

28 J E Engstadt J Am M Ass 1919, 12:11 Sudden pain in the epigastrium was noted while lifting a heavy object twelve hours previously The abdomen was rigid and tender A tense mass was present in the epigastric region Laparotomy The upper portion of jejunum was strangulated through the foramen of Winslow Traction was useless for reduction of the hernia It was found necessary to introduce the tip of the little finger into the tight opening, carefully severing first the peritoneal coat and gradually the connective tissue of the opening Great care was taken not to injure the portal vein or common duct After this moderate traction accomplished reduction Two small drains were employed and were removed on the second day A fecal fistula developed on the tenth day which discharged for five weeks and finally closed

29 Schmilinsky Deutsche med. Wchnsch 1919, xiv 4. A man, aged 65, for three weeks had had pains in the epigastrium after eating Laparotomy The caecum and last part of ileum had entered the lesser sac through the foramen of Winslow These had torn the lesser omentum and lay free just above the lesser curvature of the stomach Traction was employed and reduction was readily accomplished Flatus and feces passed on the second day after operation

The following case brings the series of hernie through the foramen of Winslow up to 30

May 27 1922 T D a man, aged 49 was admitted as an emergency case. He was toxic and no history could be obtained from him. From his family physician it was learned that he had been taken ill one week previously with general abdominal pain, nausea and vomiting. For the first two or three days, constipation was present. Later a severe diarrhoea developed. The patient grew progressively worse. He had refused to come to the hospital for about a week. Marked distention of the abdomen was present for two days before he was admitted. No history of any previous digestive or abdominal disturbances was obtainable. The past history was negative except for furunculosis in pro.

P E Middle aged man, eyes sunken, face pinched and haggard, skin clammy, very toxic, orientation poor, head negative, heart and lungs negative. Abdomen: Distention throughout, but more marked in upper half. No peristaltic waves seen. His knee resistance was present but very little tenderness. Tympany was present throughout. Movable dullness was noted in the flanks. No masses were made out. Urine positive for albumin and hyaline casts. Blood: white blood cells, 6,400, 86 per cent polymorphonuclears.

Operation: Under gas and ether anaesthesia a right rectus incision was made. Brownish fluid escaped on opening the abdomen. The small intestines were greatly distended. Below the cecum, the intestines were flaccid. In the presence of the distended loops, the point of obstruction was not determined. Several punctures were made for the escape of feces and flatus, but the distention was only partly relieved. These enterotomies were closed with black silk. The patient's condition was so critical that it was thought best to do as little operative manipulation as possible. A loop of distended gut was brought out of the abdomen and sutured to the peritoneum. This was later opened with the cautery. Patient died about six hours later.

Autopsy: The operative incision was enlarged up and down. Almost all of the small intestines were dilated. The large bowel was collapsed. Four inches of ileum, one and one half feet from the ileocecal valve had passed through the foramen of Winslow. This was withdrawn without difficulty from the lesser sac. This portion of gut was almost gangrenous, reddish black in color.

The enterotomy was performed two feet above the obstruction.

#### ANATOMICAL CONSIDERATIONS

The foramen epiploicum or the foramen of Winslow was first described by Winslow in 1776. It is a semilunar or semicircular orifice which serves as a communication between the lesser sac and the general peritoneal cavity. It is about 8 centimeters in circumference, 5 centimeters from the mid line on the right at the level of the upper edge of the first

lumbar vertebra. It corresponds on the abdominal wall to the intersecting point between a line uniting the seven costal cartilages and a vertical one one finger's breadth external to the right border of the sternum. Studies on the cadavers by Jeanbrau and Riche have shown that the orifice easily admits the index finger. Radovan in his researches, also on cadavers found that the index and middle finger could be easily introduced. The foramen of Winslow is bounded anteriorly by the lesser omentum posteriorly by the inferior vena cava above by the caudate process of the liver and below for all practical purposes, by the first portion of the duodenum.

The lesser omentum should be considered in connection with the surgery of the foramen of Winslow. It forms the anterior boundary of the hiatus. Between the two layers of the peritoneal folds of the hepatoduodenal ligament, the portal vein can be found behind with the hepatic artery and common duct in front, the former to the left and the latter to the right of the portal vein. The edges of the orifice cannot be incised without injury to these three structures.

Jeanbrau and Riche in a splendid article have called attention to a relatively bloodless space in the posterior leaf of the gastro-hepatic ligament—the inter-porto-choledochus space. It is triangular in shape with the base below and mostly retroduodenal. In the region of the pancreas and the duodenum the interval between the portal vein and common duct is quite large and allows one to enter the lesser sac without injury to the above structures.

#### ETIOLOGY AND MECHANISM IN THE PRODUCTION OF THE HERNIA

Hernie through the foramen of Winslow are rare no doubt due to the fact that the orifice is placed high in the abdominal cavity and is concealed by the small intestines and the transverse colon. Violent efforts may be responsible and explain the greater frequency in men. Only five females are mentioned (Treitz, Groves and Marten, Delkeskamp, Schwalbe and Radovan) as compared to 20 males and in 5 no sex is mentioned.

The following occupations are noted: gardener (Rehn), agriculturist (Mori), engineer (Cawardine).

In one case the onset of symptoms began immediately after a difficult stool (Groves and Marten) and in another after defecation (Morton) after a coughing attack (Sindclair) and immediately after a normal labor (Delkeskamp) two hours after a heavy meal (Treves) and while lifting a heavy load (Engstadt).

Any undue abdominal contraction, as in constipation, defecation, labor or heavy lifting may be a factor in the production of a hernia through the foramen of Winslow. It is possible that purgatives increasing peristaltic movements may be another agent in its etiology. An existing obstruction may be responsible, the intestine combating against the obstruction and trying to empty itself may enter the foramen as in Picado's case.

#### AGE

The age at which hernia through the foramen of Winslow occurred is indicated in 20 patients. The youngest was 5 years and the oldest 66 years. This type of hernia may occur at any age. The following ages are noted: 5 years (Haw), 8 years (Picado), 6 years (Jeanbrau and Riche), 10 years (Hayman), 12 years (Delkeskamp), 15 years (Square), 16 years (Treves, Neve), 32 years (Treitz), 34 years (Schwalbe), 44 years (Majoli, Cawardine), 46 years (Groves and Marten), 49 years (Ullman), 50 years (Mori), 56 years (Gangolphe), 58 years (Sindclair), 61 years (Stecchi), 64 years (Rehn), 65 years (Schmullinsky).

#### CAUSES OF STRANGULATION

The strangulation of the bowel is, as a rule, the result of constriction by the edges of the orifice which is often thickened and congested. Jeanbrau and Riche have described a peritoneal fold at the lower edge of the foramen and attributed to it an important rôle in the causation of the strangulation. In Stecchi's case the symptoms of obstruction were due to an adhesion of the greater omentum to the edge of the foramen, and not to strangulation at the orifice. In another case (Blandin) the

intestines passed through a dilated foramen of Winslow and the obstruction was caused by a narrow abnormal opening in the transverse mesocolon. It is well to bear in mind that intestines may pass through the foramen of Winslow without being strangulated.

#### CONTENTS

The hernial contents are variable lengths of small or large intestines and occasionally the greater omentum (Majoli, Stecchi). The small intestines are found herniated into the lesser sac twice as often as the larger bowel. In twenty-seven observations, nine were cases in which the large intestines had passed through the foramen of Winslow: (1) transverse colon (Groves and Marten), (2) Neve, (3) Majoli, (4) cecum and ascending colon (Mori), (5) cecum, ascending colon, and part of transverse colon (Treves), (6) end of ileum, ascending colon and cecum, (7) appendix, cecum (Delkeskamp) and part of ileum (Haw), (8) ileum, appendix, cecum, ascending colon and greater part of transverse colon (Radovan), (9) cecum and last part of ileum (Schmullinsky).

In three, almost the entire length of the small intestines passed through the foramen of Winslow (Blandin, Stecchi, Reynier).

#### SYMPTOMS

The symptoms of strangulated hernia through the foramen of Winslow are those of intestinal obstruction, namely pain, vomiting, distention, absence of feces and flatus.

Clinical studies follow based on twenty-two cases of the total thirty.

**Pain.** As a rule the site of the pain is in the epigastrium or the umbilical region and occasionally in the right hypochondrium. Often there is generalized abdominal pain (Cawardine, Ullman). In Haymann's patient with advanced tuberculosis lesions, pain was localized to the lower right thorax. In one the pain was referred to the right iliac fossa (Radovan).

As a rule the onset of symptoms is sudden. In some cases (Picado, Groves and Marten, Schmullinsky, Ullman) the symptoms progressed gradually and suggested incomplete obstruction. The acuteness of onset depends

on the degree of intestinal constriction. At times the pain may be terrific. Square's patient doubled up in Treves' patient the pain was so severe that the patient could not sleep and had to pass the night in a chair. Radovan described his patient as having violent cramps.

**Vomiting** Vomiting is an early sign. But in Sinclair's case it did not appear until the third day of the illness. At first, it is liquid in character; later it becomes fecal. Yet in Majoli's case where the obstruction was not complete until the thirty-fifth day vomiting was fecal from the start. In many the type of vomiting is not indicated; some speak of frequent vomiting. In Treves' case, the vomitus was always intestinal. In Jeanbrau's and Riche's case vomiting was alimentary at the time of operation. Cawardine's patient had vomitus as black as ink. Morton also described the vomitus as bilious in character.

**Absence of feces and flatus** This is the most important of all signs and is almost always constant. In Majoli's and Neve's cases the obstruction was never complete and in both the large bowel was strangulated. In my case constipation was present for two or three days and was followed by a severe diarrhea up to the time of the operation. But in most of the cases nothing passed by the bowels; enemata were ineffectual and the obstruction was complete from the start.

**Physical signs** An important sign is an epigastric or periumbilical swelling appearing soon after the onset of symptoms. As a rule, the swelling is in the mid line, though occasionally it encroaches on the right hypochondrium. Even in the presence of generalized abdominal distention, the tumor in the epigastric or umbilical regions stands out prominently. But, as a rule, the tumor is masked by the abdominal fullness. It is important, therefore, to examine the patient early before the distention has become general. Epigastric swellings are noted by the following: Majoli, Neve, Picado, Stecchi, Mori, Jeanbrau and Riche and Sinclair. Cawardine described the abdomen as distended but offering resistance in the epigastric region. Engstadt's patient also had abdominal distention with a tender mass in the epigastrium.

In my case, the entire abdomen was ballooned out, but the distention was more marked in the upper half. Periumbilical swellings were noted in two cases (Reynier Square). In others, nothing more than abdominal distention was made out. These tumorfections, the epigastric and periumbilical are present, irrespective of the portion of the intestine strangulated. In Picado's and Stecchi's cases it was the small intestine. In Majoli's case it was the transverse colon.

### DIAGNOSIS

A pre-operative diagnosis of a hernia through the foramen of Winslow has never been made and rarely has it even been suspected. Neve was the closest with the diagnosis of internal hernia. Intestinal obstruction is the usual diagnosis.

Even at operation the diagnosis has often been missed, especially in the presence of distended loops of intestine. Treves and Mori arrived at a diagnosis by a process of exclusion. Stecchi thought of the condition after he had reduced the hernia and introducing his hand into the foramen of Winslow found that it was easily admitted. Haymann also suggested a hernia through the foramen of Winslow but never was able to prove it. Positive diagnoses at operation however were made by Sinclair, Radovan, Engstadt and Schmilinsky. In my case, the patient was so toxic that no effort was made to learn the cause of the obstruction. An enterostomy was the only operative procedure justified.

### TREATMENT

Surgical intervention is an immediate indication when intestinal obstruction is suspected. Were it possible to make a diagnosis of a hernia strangulated through the foramen of Winslow the incision would no doubt be the same as for any biliary operation. In most of the cases a mid line incision, extending above and below the umbilicus for variable lengths was employed, often with excellent exposure.

Twenty laparotomies were done; twelve of these were followed by death and eight patients were cured. The remaining ten were either autopsies or cases in which death

occurred before any operative procedure was attempted.

If the patient is desperately ill it is wise to do as little as possible—an enterostomy on the first dilated loop that presents itself. More of course can be attempted in patients who are better risks. If possible one should determine the cause of the obstruction: (1) adhesions, (2) volvulus, (3) torsion of mesentery, (4) intussusception, (5) strangulation in an abnormal internal orifice of the mesocolon or the mesentery or in the duodenojejunal fossa. To determine if the hernia has passed through the foramen of Winslow, the index finger should be introduced under the liver and search be made along the right border of the gastro-hepatic omentum to make out the pulsation in the hepatic artery.

If one is reasonably certain he is dealing with a hernia strangulated at the foramen of Winslow, he may then proceed with the following operative manipulations:

1. *Reduction by simple traction.* It is possible that reduction may occur as soon as the operator plunges his hand into the abdomen (Haymann). In certain cases (Mori, Groves and Marten, Delkeskamp) the herniated bowel was easily withdrawn from the lesser sac simply by traction. In others (Rehn) it was reduced by this method with difficulty. In others, again (Ireves) traction failed to release the strangulation and in Majors's case this was impossible even at autopsy. Cawardine found that complete reduction by traction was prevented by a vascular band and that only partial reduction could be accomplished.

2. *Preliminary enterotomies and traction.* Radovan has emphasized initial preliminary enterotomies, single or multiple, followed by careful closure of the intestine with a double row of Lembert sutures. These enterotomies are performed in order to lessen the distention and to evacuate the bowel, thereby facilitating reduction by simple traction of the hernia strangulated through the foramen of Winslow.

Two points are to be observed where simple traction is employed. (a) See to it that every loop of strangulated intestine has been disengaged. Introduce the finger into the foramen of Winslow to determine if it is empty.

Gangolphe thought he had liberated the entire hernia when he saw a point of obstruction but at autopsy more than a meter of intestine was found in the lesser sac. (b) See to it that the greater omentum is not in the lesser sac. In Steechl's case the hernia was reduced, but at autopsy three days later the omentum which was adherent to the edge of the foramen had caused angulation of the transverse colon and had given rise to intestinal obstruction.

3. *Reduction by traction after dilatation of the Foramen of Winslow.* If with gentle traction the strangulation does not yield, strong traction is contra-indicated. The intestines have already degenerated to some degree and violent methods may rupture the bowel. One may try to dilate the foramen, employing the utmost care.

In this series of cases two fall into this group (Sindclair and Engstadt). The former applied gentle traction to the orifice and then found that the herniated intestines could be withdrawn from the lesser sac with ease. In the latter case it was found necessary to introduce the tip of the little finger into the tight opening carefully severing first, the peritoneal coat and gradually the connective tissue of the foramen, great care being taken not to injure the portal vein and common duct. Reduction was then rendered possible with moderate traction.

If the methods just described prove unsatisfactory there remain two procedures at the disposal of the surgeon: (1) reduction of the hernia after opening the lesser sac and (2) reduction after incising the orifice (*débridement*). Opening into the lesser sac is the method of choice first, because incision of the orifice may injure the portal vein and common duct and secondly opening into the lesser sac allows for inspection of the herniated contents to determine the condition of the loop of bowel, whether adhesions are present or whether the intestines are twisted or perforated. Through such an opening it is possible to perform preliminary enterotomies upon the strangulated intestine for relief of distention and the discharge of intestinal contents. Blandin found that the intestine had passed through the foramen of Winslow without

strangulation, and had then passed through an abnormal opening in the transverse mesocolon and was strangulated there. In Schmilinsky's case laparotomy revealed a hernia through the foramen of Winslow which had bored into the lesser omentum the cæcum and last part of ileum lay just above the lesser curvature of the stomach. Taxis was employed and the hernia yielded without difficulty.

In Delkeskamp's case almost the entire length of the large intestine was seen to have passed through the foramen of Winslow which was dilated to admit three fingers. The intestines were in places distended and in places flaccid and were covered with a peritoneal fold which proved to be the anterior sheet of the lesser sac. This was torn open, some adhesions were released and the intestines were then drawn into the abdominal cavity through the foramen of Winslow.

In Radovan's case, the lesser sac was opened through the transverse mesocolon the intestines emptied by enterotomies and reduction accomplished by traction.

Whether to enter the lesser sac through the lesser omentum or the transverse mesocolon is a question of judgment for the surgeon but the latter approach is regarded as the safer.

*Enlargement of orifice by incision.* This method has never been tried on a human being. Treves and Neve were in accord in

their views of the impossibility of this method. Incision of the edges is dangerous. The hepatic artery common duct and portal vein are liable to injury. Jeanbrau and Riche have elaborated a technique of *débridement* on the cadaver by approaching the foramen through a route which they call the inter porto-choledochus space. This lies behind the pancreas and is retroperitoneal. Here the interval between the portal vein and common duct is quite large and allows easy access into the lesser sac. For detail the reader is referred to the original article.

This method appears difficult and time consuming and is not a proper operative procedure where speed is an important factor. Silvada Brainer called attention to the dangers associated with it. In twenty cadavers the space did not exist and in the remaining half it was traversed by various blood vessels.

In conclusion, one might ask, will a preoperative diagnosis ever be made of a hernia strangulated through the foramen of Winslow and will it be differentiated from other internal hernia? That remains to be seen. At present, the important point is to *diagnose intestinal obstruction and to operate at once.*

In this way the prognosis in hernia strangulated at the foramen of Winslow can no doubt be rendered more favorable.



# DEPARTMENT OF TECHNIQUE

## COMPRESSION LIGAMENT FRACTURES OF THE ANKLE JOINT

By JAMES H. STAVINS, M.D. BOSTON, MA. SURGEON

THE accepted classical definition of a Pott's fracture is a fracture of the fibula 2 to 4 inches above the joint and an accompanying fracture of the internal malleolus or a ruptured internal lateral ligament. Pott described a fracture of the fibula 3 inches above the joint and a broken internal lateral ligament and this is so rare as to be negligible. A rupture of the internal lateral ligament occurring in any of these various fractures as we shall prove, only a result of extreme dislocation of the talus. We are told that all the other fractures of the fibula at its lower end are not Pott's because there is no breaking of the internal malleolus and no rupture of the internal lateral ligament. One could easily imagine a fracture of the fibula by a comparatively slight blow (direct violence) which would produce nothing except a bony lesion. The damage would be slight and the prognosis in such a fracture would always be good.

But a man steps from a curb, his foot strikes an uneven surface in the pathway and turns outward. There is impact behind the force and the weight of the man is added to the impact. The fibula breaks at the joint surface usually, but occasionally above it as in the classical type.

The inferior tibiofibular ligaments are stressed always; damaged the tip of the fibula swings outward and usually backward. There is widening of the mortise of the ankle joint and whether or not it occurs, there is the potentiality of dislocation. There is a great deal more damage than in the case of the direct blow and there is a tremendous injury to the joint itself which is not present in the other case. One is ephemeral. The other is dynamic and its effects are lasting.

There is strikingly little difference in the X-rays to the casual observer, but the differ-

ence is there. In disagreement with many of my colleagues. If we are to cling to the old nomenclature such an injury is a Pott's. If the ordinarily accepted definition is only a definition of one variety of the fracture and that variety one which while more severe is numerically less than other types and if by the very specificity of its wording it excludes absolutely the others, then it is clear that it has not only failed as a definition but it is infinitely worse than this because it has fogged the whole subject.

If we classify these injuries under the terminology which we have used in this paper we shall be able to group them scientifically since etiologically there are certain mechanical features which are common to all.

*First compression* because it is the most important feature and it is always present in every case, the weight of the man (static compression) plus the infinitely greater compressive stress due to impact. These breaks at the ankle are not pure compression breaks, but the compression by keeping the astragalus firmly against the tibiofibular mortise while at the same time causing the locking of all the tarsal articulations determines to a great extent the character of the injury.

*Second leverage* because there is a leverage stress in two directions with compression on one side of the breaking bone and tension upon the other.

We subdivide this into eversion and inversion and by further subdivision we are able to group all these various types in a truly scientific manner which was never possible under the old nomenclature.

The etiology of all these injuries to the ankle joint is practically the same. A person steps from a height like a curb and turns his ankle. He falls or slips and does the same

thing. Running or jumping he turns his ankle in alighting. In the case of ball-players he slides for a base and encounters an obstruction with his foot. Sometimes with a heavy person it happens in the course of ordinary walking over rough ground but usually there is the phenomenon of impact.

Now the medical profession as a whole, is united on certain of the fundamental mechanical features of production while differing on minor points.

Stimpson, Bonnet, and Tillaux believe that the internal lateral ligament tears or the internal malleolus breaks first and is followed by a fracture of the fibula.

Messenneuve, Speed, Ashurst, and Murphy believe that the fibula breaks first and that following this break the internal lateral ligament tears or pulls off the internal malleolus.

So that there is agreement between these two groups, that there must be a turning downward of the astragalus. Because if the internal malleolus breaks before the fibula through the pull of the internal lateral ligament as they claim, or the internal lateral ligament is torn, then this can be accomplished only by a dropping down of the inner edge of the astragalus, and equally as clearly if the fibula has broken first and the internal malleolus is broken by the pull of the internal lateral ligament or the ligament is torn as the other group claim then it must also be done by a dropping down of the inner edge of the astragalus because if caused by the astragalus slipping outward, there would always be the outwardly dislocated astragalus remaining and this is not true. Many times the astragalus is not dislocated and nevertheless the internal malleolus is broken. This is a statement of fact and can admit of no controversy.

The third class and this is composed of some of each of the other classes, believes that there is a rotation outward of the foot pivoted on the astragalus and that the internal lateral ligament breaks first or pulls off the internal malleolus. This was Messenneuve's idea originally.

In order to demolish the theories of the two first groups it is only necessary to prove that

the astragalus does not turn and in order to demolish the contentions of the third group it is only necessary to prove that the internal lateral ligament does not tear and is not stressed except as the result of a dislocating astragalus. No one cares what a man's individual opinion may be if he cannot prove it. If he can it will stand by itself even against a combination.

Figure 1 represents schematically the claim which is made by these two groups, that the astragalus is turning to bring the line  $A-D$  into the line  $1-D'$ . Can we prove this impossible?

Figure 3 will show you that the bones of the leg and foot constitute a column varying in area at different points and that the base of this column is offset to the fibula side always. In other words you walk on the fibula side of your foot.

Let us call the area of our column at the level of the astragalus as 1 inch by 1 inch (the bearing surface) and the man's weight 150 pounds. By the use of a simple mathematical formula it is possible to determine the compressive stress within practical limits. Let  $A$  equal the length and  $B$  the breadth of any section of our column at any level.

$$\frac{\text{Load}}{A \times B} = \text{Compressive stress in pounds per square inch}$$

$$\frac{150}{1 \times 1} = 150 \text{ pounds of compression}$$

This compressive stress is the same over the entire area of the astragalus. But this is not all. The center of compression of our column is the center of the column, the neutral axis. But because the base is offset in the ordinary standing position the line of resistance through the base is fully 0.5 of an inch away from the center of compression and when the os calcis abducts under force this line of resistance is further removed so that it may even fall outside the fibula surface of the column.

This last mentioned condition in the face of stress would mean infinity. It could not be measured.

But let us assume the problem as before with an offset of 0.5 of an inch. The offset is called the lever of eccentricity.





Fig. 3

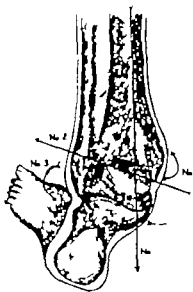


Fig. 4

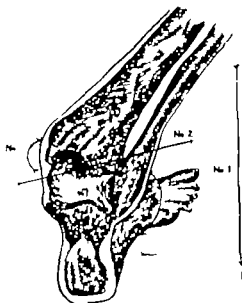


Fig. 5

Fig. 3 The distance from the center of the column or strut is the lever of eccentricity. Problem: Weight of man, 50 pounds, area of column 1 square inch, each by 10th lever of eccentricity 1 inch. A B center of column and also neutral axis in ordinary standing position of foot. C D base of resistance. G H lever of eccentricity in abduction represented by dotted line. F E line of resistance. G I lever of eccentricity.

$\frac{50}{1} = 50$  pounds of straight compression, due to static load over entire column. Additional stress due to eccentricity

$$50 \times 5 = \frac{F \times X \times X}{6} \text{ in. each } F \text{ is cortical stress}$$

F = 450 pounds compression on fibula side

F = 490 pounds tension on tibial side

450 pounds compression due to eccentricity plus 50 pounds straight compression equals 500 pounds compression on fibula side at astragaloid level.

450 pounds tension due to eccentricity on tibial side minus 50 pounds straight compression equals 400 pounds tension on tibial side of our column at the astragaloid level.

Can 600 pounds be offset by 400 pounds?

If not, the astragalus cannot turn.

The heavy outside bones above have the leg and foot bones represent column always with an offset base to the fibula side. Each explains why fibula fractures are more common and why the apparently simple cases are always serious.

ankle outward. This tremendous compressional force must be dissipated and is only distributed at the expense of all the ankle tissues bony and soft. This is the dynamics

injuries. Dissipation of great compressional stress results in such injury and is not confined to the bony structure.

Fig. 4 First method in mechanics of eversion. Arrow shows center of gravity internal to eversion foot. Arrow shows resultant of the eversion stress due to the lever of abduction. Arrow 3 shows direction of the twisting stress, responsible for long fragments and for posterior displacement of the inferior fibula fragment, due to the lever of rotation. Arrow 4 shows direction of the twisting stress expended on the internal malleolus and causing not alone its fracture, but the anterior displacement of the internal malleolus so often present in the eversion type due to the lever of rotation.

Note in both drawings, Figures 4 and 5 the relations of the tip of the fibula to the os calcis and the astragaloid os calcis articulation showing how impingement of the articular rim of the os calcis in sliding outward, may break off the external malleolus low down when the stress is made and the victim recoils his equilibrium is gone to avoid more serious injury.

Fig. 5 Second method in mechanics of eversion fractures. Arrow shows center of gravity in this case far external to turning ankle. In reality the man is turning on his fixed astragalus. Note how toeing out of the foot (the civilized foot) will tend to prevent the ankle from rolling over into inversion and thus saving itself. Resultant of twisting stresses are same as in preceding. Arrow shows resultant of eversion. Arrow 3 shows direction of twisting stress on external malleolus due to the lever of rotation. Arrow 4 shows direction of twisting stress on internal malleolus due to the lever of rotation.

of compression and it is always greatest on the fibula side.

Under compression, a column or a strut is subject to leverage breaking stress also but

with modification a much smaller stress will serve to fracture.

Every engineer is instructed that during the test of a boiler under hydrostatic pressure he must be especially careful that the boiler be not subjected to any sudden blow. The same thing applies to an iron or steel support undergoing compression. Rupture is produced by a slight additional stress.

The astragalus cannot turn but it is closely applied to the side of the external malleolus and is applying pressure. There is clearly a stress of intensity and the tendency would be to break exactly at the fulcrum because under compression it would require a very slight additional force and the fracture might be fragmented especially where the compression approached the elastic limit of the breaking bone because in the terminology of the mechanical engineer bone is cold short and therefore subject to fracture from a small force acting as impact or as a transverse breaking stress.

The fracture is the result of compression plus leverage in two directions. The terminology is not clear. One man uses abduction to mean the turning outward of the whole foot and eversion to mean a rotation outward of the forward part of the foot. Another uses both terms to mean a turning outward of the whole foot and rotation to mean the twist of the forward part of the foot outward or inward.

We use the term abduction and eversion as synonymous. Abduct to withdraw from the body axis; evert to turn out. Therefore the entire foot is withdrawn or turned out. The term rotation means the twisting of the foot on the center of the astragalus as a pivot; therefore the forward part only is turned out. These two stresses are simultaneous.

A pure abduction or eversion without external rotation is a rarity.

A pure adduction or inversion without internal rotation is an impossibility.

There are two distinct levers formed: first the lever of abduction or eversion and second the lever of rotation.

As can be plainly seen by glancing at Figures 4 and 5 there are two distinct mechanical entities involved in these eversion fractures.

The first is produced while the center of gravity of the entire body remains internal to the foot, potentially turning outward on the astragalus. The second, while the center of gravity is external to the foot. In the first method the foot is the moving portion; the lever of abduction is a short lever, a pinch lever; the power applied below the fulcrum is the inferior tibiofibular ligaments and the weight is the weight of the man but the strength of the lever is only the tensile strength of the inferior tibiofibular ligaments or of the external malleolus, and this is under compression almost to its elastic limit. The bending and breaking moments of a short rigid lever are the same and if the inferior tibiofibular ligaments hold the fibula breaks at the joint level (Fig. 4).

In the second method the foot is the fixed portion; the man's weight being the power as he falls outward. The fulcrum is the point of contact of the tibia and fibula and the weight is not only the weight of the foot but of the foot fixed under compression and therefore the entire weight of the man (Fig. 5).

Here is a long lever with the fulcrum a little higher up than in the other case. A long lever whose bending and breaking moments are not the same will tend to break between the fulcrum and the power but nearer the fulcrum in exact ratio to the nearness of its breaking and bending moments, and as the fibula is comparatively rigid it will break with frequency at the fulcrum. It would do this even more often except for the anatomical fact that it is very much weaker at a point 2.5 to 3 inches above the tip. Therefore occasionally especially by this second method of production the fibula breaks high up.

But you say that all these fractures at the level of the joint numerically greater than the classical type are not Pott's, especially those produced by this first mechanism of ours, where the line of gravity is internal to the ankle undergoing stress.

If you will fashion two pieces of wood as the bones are shaped, or approximating them, and fasten them immovably at the points corresponding to the inferior tibiofibular articulation and apply force in the direction indicated by the first method, i. e. outwardly against the

external malleolus, you will find that you will get a fracture at the level of the joint.

If you will make the junction with a rubber band allowing only a very little play you will find provided your artificial fibula is about the same strength throughout its entire length that occasionally you will get a break higher up not often but occasionally. If you model your artificial fibula so that 2 5 to 3 inches above the joint its area is to that below as the area of the normal fibula, that is roughly as 1 is to 4 and allow for a little elastic motion at the artificial tibiofibular joint you will many times get a fracture 2 5 to 3 inches above. So that the explanation seems clear. There may be occasionally enough play in these ligaments to vitiate the fulcrum at this point or if the stress is great, and the impact severe the ligaments may rupture or give enough to render useless the normal fulcrum of our lever. Instantly the fulcrum changes to a point higher up to the lower surface of a ligamentous structure infinitely stronger than the inferior tibiofibular ligaments, the interosseous membrane and as 2 5 to 3 inches above the tip is the weakest point of the lever and is near to the fulcrum of the new lever it breaks at that point.

The majority of the milder types of injury are produced by the first mechanics. The majority of the more severe are produced by the latter mechanics, but since the results are identical and the stress the same save in intensity it is a distinction without a difference and if one is a Pott's so is the other serious or mild.

The third group contend that these fractures are in the main due to rotation of the foot. If they would let it go at that there would be reason in their contention since it is certain that next to compression this is the most important movement and not only aids in breaking the fibula but is always responsible for the broken internal malleolus in eversion fractures and for the broken external malleolus in inversion fractures. It is also responsible for the broken tibiofibular ligaments especially when this occurs without fracture but most of this group go further and claim that the internal malleolus is first pulled off by the strain of the internal lateral ligament or that



Fig 6 This shows how in an inverting foot there is separation of the external calcaneo astragaloid joint. It falls short of dislocation because the external calcaneo astragaloid joint which is not seen in this view is at a higher level. This explains why the middle fasciculus of the external lateral ligament is so often injured in these inverting ankle injuries. Nothing of this kind can happen in the eversion foot, but instead the greater the eversion the tighter these bones are locked, except for slight lateral slip in straight eversion.

the ligament is broken. This internal lateral ligament seems to be an ever present obstruction.

We know that the distance from the astragalus forward to the toes is much greater than the distance from the same point to the posterior end of the os calcis in almost the proportion of 4 to 1 and that the foot is converted into a lever the long arm in front the pivot being the middle of the astragalus.

This is the lever of rotation (see Fig 2). It may be called a lever of the first class if we choose to consider the external malleolus as the fulcrum and the point of contact on the internal malleolus as the point of application of the weight.

It could equally as well be called a lever of the second class if we take the internal



Fig 7



Fig 8



Fig 9

Fig 7. Roentgenogram of an eversion injury. Practically it is Pott's fracture without the fracture. The inferior tibiofibular ligaments are ruptured. There is therefore destruction of the mortise and here there is some out and dislocation. Only case of this type in our series. Very rare, 4 per cent of our series, but 5 per cent showed the feature of ruptured inferior tibiofibular ligaments in eversion with other types. This represents only those which show this feature clearly in the roentgenogram plate.

Fig 8. Type —Simplest type of eversion injury. Periosteal tear of fasciculus of internal lateral ligament which runs down from the tip of the internal malleolus to the

sustentaculum tali (8 per cent of our series). This is much rarer injury than the periosteal tear of the external lateral ligament from inversion. Both commonly due to the easier separation of the external calcaneo- astragalar joint.

Fig 9. Type —Lever fracture. Mild type of lever age fracture. Note large expansion of calcaneo- astragalar joint. The cause of this injury is stress of low intensity and the sliding over of the expansion of the malleolus at the astragalar or calcaneal joint striking the tip of the fibula. If the inferior tibiofibular ligament is not ruptured it is of small importance and slight healing may be permitted with care early (8 per cent of our series).

malleolus as the fulcrum and the external malleolus as the point of application of the weight.

This lever of rotation is a short lever a punch lever but in our case the lever is stronger than either the fulcrum or the weight to be overcome because the fulcrum is only as strong as the tensile strength of the external malleolus, and while the weight to be lifted is still the man's entire weight yet practically this is also limited to the tensile strength of the internal malleolus.

Which one will break?

In eversion the external malleolus has already imposed upon it by other stresses and especially the compressional a greater strain than the internal. If for no other reason it would break oftener than the internal but certainly one or both will break because both are weaker than the lever and if under the conditions of that particular stress their strength is equalized they will both break, but if both break they will break simultaneous, because

*a lever is destroyed the instant that anyone of its components gives way.*

Here then we claim to have demolished the contention of the third group in so far as the internal lateral ligament is concerned, because if the astragalus is wedged against the internal malleolus from behind forward it is certain that no portion of the internal lateral ligament can be stressed or torn until one of the malleoli breaks, because between the two fixed malleoli the astragalus cannot rotate.

If the internal malleolus breaks the ligament is free and can suffer no harm. If the external malleolus breaks, or the inferior tibiofibular ligaments tear the internal lateral ligament can only be injured as the result of the subsequently dislocating foot.

This disposes of all the groups and we believe we have demonstrated all of our points.

#### INVERSION TYPE

Why is it that there are so few of these inversion fractures in comparison to the



Fig. (at left) Type 3—L. eversion fracture. Sub Div. A. Only the internal malleolus has suffered. The internal malleolus is apt to be displaced anteriorly if due to eversion, and this is one of the diagnostic points of eversion. This half of fracture of the internal malleolus is not uncommon due to the fact of the astragalus. Many times such lesion occurs when the compression feature of these injuries (eight) is not present, but not absent. This type A and B represent 6 per cent of our series here it clearly eversion.

Fig. Type 3—L. eversion fracture. Sub Div. B. Same mechanics as before but more joint result when compression is feature. The external malleolus has resisted the stresses, but the inferior tibiotalar ligaments has ruptured, thus permitting dislocation. The internal lateral ligament is intact. Notice how impossible it could be to apply the ordinary definition of Pott or Dupuytren to this injury. Nevertheless the mechanics are the same and practically the pathology is the same. What difference could an additional broken fibula make?

eversion? It is certain that for every man who turns his foot outward there are ten who turn it inward. There are probably many more injuries due to inversion than to eversion but the pathology is that of an ankle strain or sprain in the great majority. A serious injury is escaped many times because if he turns his ankle inward he involuntarily applies the principle of jin jitsu. In other words he gives with the force and fall thus distributing the stress.

Try it with your foot—both in the position of inversion and eversion the weight on the foot under strain—and see how easily you can give in the inversion position and how impossible it is with an everted foot.

Now there is no stress in this form of injury tending to pry the external malleolus directly outward as in the eversion type. Then why should the external malleolus break at all? Is the breaking of the external malleolus in inversion fractures due to avulsion of the malle-

olus by the external lateral ligament as is claimed?

The tibia is under compression as we have shown and the astragalus cannot turn. There is no such lever of eccentricity as in the eversion type except posteriorly but there are the static and impact compressional stresses exactly as in eversion. The break is because of the lever of rotation and often you will find the external malleolus displaced forward instead of backward especially where there is fracture of the external malleolus alone from inversion.

Backward dislocation is a far more frequent accompaniment of this type of injury and is due to the greater stress suffered in serious cases because of the greater latitude of movement at the various articular surfaces in this position. The very same factor which, in mild stresses enables him to save his joint from any injury in serious stresses acts to increase the force, because even the slight increase of





Fig. 2

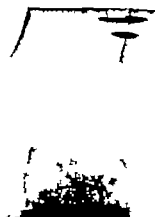


Fig. 3



Fig. 4

Fig. 2. Type 4—Eversion fracture. Sub Div A. A leverage fracture. Break of the fibula clearly at joint level. Some displacement outward of lower fibula fragment. This is the most common type. No break of internal lateral ligament. N fracture of the internal malleolus (42 per cent of our series).

Fig. 3. Type 4—Eversion fracture. Sub Div A. Great outward displacement. The internal lateral ligament may or may not be ruptured in this type, but if so, is usually not entirely ruptured, but torn. The tearing is

directly dependent on the degree of the external displacement, and is rarely tremendous, even with great displacement. The fracture of the external malleolus is clearly at the joint level, but runs up posteriorly (4 per cent of our series).

Fig. 4. Type 4—Eversion. Sub Div B. Same mechanism, but fracture of fibula is high up. In this case only short distance above the joint level, but often higher (48 per cent of our series).

latitude gives an added momentum to the stress. Figure 22 shows what a tremendous injury is possible from simply stepping from a four inch curb with inversion of the foot.

There remains only to be considered the splits of the tibia which occur both alone, and as complications and these may be divided into three classes, ordinarily

1. Posterior splits of the tibia, with or without other injury and these are extremely common (Fig. 25)

2. Anterior splits of the tibia which are rarer than the posterior but by no means uncommon (Fig. 27)

3. Longitudinal splits which run up the bone for some distance without being complete. These are in the nature of what is known as slips in mechanics and are comparatively rare.

All these splits of the tibia are due to impact primarily and eccentricity of the compressional stress is many times the determining factor of the posterior split.

#### CLASSIFICATION

If we are to abandon the old nomenclature, how shall we classify these various injuries?

#### SIMPLE FRACTURES

Simple fractures of the fibula or fractures of both bones of leg from direct violence are neither eversion or inversion fractures. They are due to direct violence or to simple cross breaking strains and are not to be considered under compression leverage fractures.

#### COMPRESSION LEVERAGE FRACTURES OR INJURIES OF THE ANKLE

Compression leverage fractures may be divided into two classes (1) eversion (2) inversion.

##### *Eversion Fractures*

Type 1. Simple periosteal tear of internal lateral ligament or that portion of internal lateral ligament that runs from tip of internal malleolus to sustentaculum tali of os calcis. In 249 cases it was observed only twice. This is the simplest form of eversion injury at the ankle joint and is extremely rare. It is interesting as showing that occasionally there is some separation of the internal astragalocalcaneal joint (Fig. 8).

Type 2. Fracture of the external malleolus alone half way between the joint surface and the tip. This is an eversion leverage fracture



Fig. 15

Fig. 16

Fig. 15 (at left) Type 5—Eversion Sub Div A External malleolus broken clearly at the joint level. Internal malleolus also broken. No rupture of internal lateral ligament occurs in these cases. Dislocation of foot is outward and backward. Internal malleolus is broken at joint level oftenest, but larger portions may be broken from the tibia. Mechanics as given in text. The rotation of the astragalus broke the internal malleolus simultaneously with the external malleolus (3.6 per cent of our series).

Fig. 16 Type 5—Eversion Sub Div B Same mechanics as A, but because of undue mobility at inferior tibiofibular junction, allowing more play or because of the stresses by the second method of production, and decrease in size of fibula above, the bone breaks high up. Percentage of broken internal malleoli is greater in these high breaks, because the stresses are not dissipated as quickly as in the Type A cases, and are greater. External dislocation is apt not to be so pronounced, while the posterior dislocation is apt to be more pronounced. Internal lateral ligament is not broken. A classical Pott's (6.4 per cent of our series only).

due to the impingement of the external articular rim of the os calcis as the os calcis slides outward on the astragalus and the rim of the articulation brings up against the tip of the external malleolus. Such a fracture is usually due to a stress of low intensity and direct eversion the twist being in abeyance. The external malleolus breaks half way on the transverse ligament as a fulcrum. Displacement is not usual. The mortise of the ankle joint is usually not damaged to any great extent the inferior tibiofibular ligaments not being ruptured. Weight bearing may be begun early. Dislocation of the foot is not possible and does not take place, unless the inferior tibiofibular ligaments are ruptured which is very rare (Fig. 9).

Type 3 Fracture of the internal malleolus from eversion (Figs. 10 and 11). There are in reality two types.

Sub Div A The mildest type is usually the result of the rotation stress, the foot being in extreme dorsiflexion so that the strain falls on the portion of the internal malleolus anterior to the notch and results in a break below the joint level.

If the inferior tibiofibular ligaments are not ruptured which is often the case there is no dislocation possible and the type is no more serious than Type 2. This type often occurs when the compression stress is not on the foot and we have called this type "the Polo fracture" because we have had several which were produced by the opponent's horse, catching



Fig. 7



Fig. 8



Fig. 9

Fig. 7. Shows the characteristic forward displacement of the internal malleolus. This is diagnostic of an eversion fracture when the internal malleolus is broken. Rarely is it present in the inversion type. 4.3 per cent of our series here the internal malleolus is broken without this displacement, and this represents all of the cases without ruling out those showing no displacement or the ones clearly due to inversion, which should be excluded.

Fig. 8. Type —Inversion fracture. Middle fasciculus of external lateral ligament is injured. Peroneal inversion fracture. This is common but escapes attention many

times because not X-rayed. Of little importance—5.6 per cent represent our series. But this is not the true sequence. This is probably numerically the most common of all injuries at the ankle.

Fig. 9. In eversion. Type —The stress falls at base of the internal malleolus. Such breaks, the break many times running upward. The malleolus is displaced upward or inward and backward at all but unlike eversion breaks, it is rarely displaced forward. Fibula intact. Many times it is impossible to tell so that these figures represent only those clearly an eversion, but it is certain that inversion breaks of this type are more common (3.1 per cent of our series).

the foot of the man and twisting it outward. Where the compression feature is not in evidence, it is possible that there is a certain amount of turning motion possible to the astragalus which permits the internal edge of the astragalus to drop, thus making these half way breaks more likely (Fig. 10).

Sub Div. B (See Fig. 11). The internal malleolus is broken at the joint level. The fibula is unbroken but many times the inferior tibiofibula ligaments are ruptured. If so dislocation of the foot outward is possible and is many times present. The fragment of the internal malleolus is displaced outward by the pull of the internal lateral ligament. If dislocation of the foot occurs. Fracture of the fibula does not occur because the tibiofibula ligaments give way first and distribute the stress, or the stress is comparatively mild and is dissipated with the break of the internal malleolus.

Type 4 (Figs. 12 and 13.) Sub Div. A. Fracture of fibula, alone at level of joint. More frequently the split runs upward and

backward due to the combination of stresses, outward and from before backward. This is clearly a leverage fracture with the potentiality of displacement, whether or not it occurs. It is due to three stresses—eversion of the foot, the astragalus being crowded over against the external malleolus, and exerting pressure outward a rotating force by which an additional stress is brought to bear against the external malleolus from before backward, and which accounts for the backwardly displaced lower fragment of the fibula which is observed so many times; and third, the compression stress which is present in all these cases, due to the weight of the man plus impact. The inferior tibiofibular ligaments are always injured in this type of case and often completely ruptured. Eccentricity being always on the fibula side bringing the acme of stress to this side accounts for the preponderance of fibula fractures.

In our series of 249 cases, 55.4 per cent were fractures of the fibula alone, and 42.1 per cent belong to this type of our classification.



Fig. 20.

Fig. 20 (at left) Type —I Inversion Same as Figure 9 but with displacement and dislocation in young subject



Fig. 21.

Fig. Type 3—Inversion A very rare type the tendency being to break the internal malleolus and thus focus the pressure or to break both bones simultaneously. If however as occasionally happens, the internal malleolus resists the strain, the external malleolus may be broken alone either at the joint or below as in this case. This is much more apt to happen if the foot is in extreme plantar flexion because in dorsiflexion, there is the tendency to anterior dislocation and the points of contact are more apt to be relieved from pressure especially if anterior dislocation occurs. In plantar flexion the posterior outer edge of the astragalus is raised so that the contact with the external malleolus is greater and rotation stress is more apt to catch it, the pressure being from behind forward. The existence of this type has been denied, nevertheless occasionally it occurs. Rupture of the inferior tibiofibular ligaments sometimes saves the fibula from fracture.

Type 4 Sub Div B (Fig 14) The fibula broken alone but higher up than the joint level. Same mechanics as A and all other conclusions pertaining to A apply to B. The high fracture of the fibula is explained in this article and is more likely to occur in that form of eversion injury where the center of gravity is outside the stressed foot. Only 4.8 per cent of our series fall in this group.

Type 5 Fracture of fibula and internal malleolus Sub Div A (Fig 15) The fracture of the fibula being at the joint level. The same mechanics as Type 4 and the same conclusions apply. The fractured internal malleolus is a matter of small importance unless so badly displaced as to need replacement. The internal malleolus is many times displaced somewhat forward, a feature which we contend is always a proof of the eversion character of the injury (Fig 17). Dislocation as in Type 4 is a possibility whether or not it occurs. The internal malleolus is nearly always broken at joint level. 13.6 per cent.

Type 5 Sub Div B (Fig 16) Fracture of the fibula high up and fracture of internal malleolus at or near level of joint as usual. The same mechanics as A of Type 5 and as Type 4, and same conclusions apply. 6.4 per cent fall into this class. This is the classical Pott's.

#### Inversion Fractures 13.6 per cent

Type 1 (Fig 18) Insertion fracture peritosteal tear of the external lateral ligament. A small chip of bone is separated from the tip of the fibula by the stress suffered by the middle fasciculus of the external lateral ligament. This is a most common type of injury and is caused by the easy separation of the external calcaneo astragaloid joint when the foot is inverted. In our series there were 5.6 per cent but it is probable that this form of injury represents the largest type of injuries to the ankle since it is probable that few of these cases are X-rayed. The injury is simple and a few days of restriction is all that is usually required with subsequent care.



Fig. 2



Fig. 3



Fig. 4

Fig. 2 Type 4, A Inversion. Inversion fracture of fibula and internal malleolus. Often accompanied as here with impact complications. The fracture of the fibula is at the joint level and the internal malleolus at the joint level but often includes a large piece integral with the malleolus. Many times dislocation lateral and posterior. It is obvious that recovery here is only possible by operation and even then doubtful. Quick motion here is out of the question.

Fig. 3 Type 4, B Inversion. The fibula is broken high up. The large piece integral with internal malleolus shows

internal dislocation is reduced, but there is still backward dislocation. Reduced, this fracture will respond almost as quickly as one apparently much less serious (Sub Div A and B represent 3.6 per cent.)

Fig. 4 Central split of tibia, breaking out both anteriorly and posteriorly with telescoping. This is an operative case and result is extremely doubtful. To apply motion quickly to such a case, even if it could be reduced without operation, or to apply any fixed rule could be, of course, absurd.

Type 2 (Figs 19 and 20) Inversion fracture of the internal malleolus. This is a common type of inversion fracture. The stresses are not distributed the strain comes against the base of the internal malleolus the same three stresses which we have mentioned in the production of the eversion types but in this case reversed. No such lever of eccentricity is present on this side however except posteriorly sometimes, and therefore, the fracture of the internal malleolus is a sheer fracture, usually the compression however preventing the astragalus from turning. The fracture begins at the joint surface and either runs transversely or up to include a somewhat larger piece. Compression splintering is not present on this side.

Dislocation of the foot is a potentiality whether or not it occurs. The fragment is displaced inward if displaced at all, and sometimes backward, but, unlike the eversion type, is not likely to be displaced forward. This

represents a differentiation where the history is not clear.

Rupture of the inferior tibiofibular ligaments may occur but is less likely than in the eversion types of injury. Of this type 3.2 per cent represent our series, but this is clearly erroneous, because many times where displacement or dislocation does not occur the history will not be clear. Many more of these cases were caused by inversion than are shown by these figures, but fracture of the internal malleolus, alone, is, nevertheless, more often the result of eversion than of inversion.

Type 3 (Fig. 21) Fracture of the fibula from inversion either at the joint or high up. This is rare, but happens occasionally. The inferior tibiofibular ligaments are usually injured but dislocation rarely occurs.

Type 4 Fracture of fibula and internal malleolus 3.6 per cent clearly inversion.

Sub Div A (Fig. 22) Broken fibula and internal malleolus. Fibula at joint level. The



Fig. 25



Fig. 26

Fig. 5 (left) Impact split of tibia. Posterior split with fragment forced upward. N. dislocation of the ankle. These may occur alone or as complication of any of the other types. This is the result of impact in plantar flexion.

Fig. 6 Impact split of tibia. Posterior with great posterior dislocation. Anterior and posterior per cent of ankle fractures alone per cent as complication of other fractures. Longitudinal splits of the tibia are occasionally encountered.

same mechanics reversed as for the same type of eversion fracture. If displacement of the fragments occurs, the internal malleolus is not displaced forward, as in the eversion type, and unless the foot dislocates, the lower fragment of the fibula is not so likely to be displaced backward. Dislocation is common however changing the picture.

Type 4. Sub Div B (Fig. 23) Fracture of fibula high up and fracture of internal malleolus. In our series this was less frequent than the Sub Div A in the proportion of 1 to 2. Exactly the same mechanics apply here, and the same conclusion may be drawn. Dislocation is common, and backward dislocation is a more common accompaniment of inversion fractures than of eversion.

There is another type of injury to the ankle joint usually the result of rotation, which without a solution of continuity of any osseous structure presents much the same condition inasmuch as the inferior tibiofibular ligaments

are ruptured the mortise of the ankle joint is broken up and dislocation is not only a potentiality but is frequently present. Such a case is represented by Figure 7 and shows clearly the outward dislocation resulting from a broken inferior tibiofibular ligament. Inasmuch as soft tissue tends to heal more quickly than bony tissue, no such period of immobilization is necessary but restriction of motion and weight bearing for a time is absolutely essential to the restoration of the efficiency of the astragalotibiofibular mortise.

#### TREATMENT

Reduction where there is dislocation is the important point and is usually easy of accomplishment. Even in the simple cases of fractured fibula from eversion either low down or high up the same force which produces the break is apt to displace posteriorly the lower fibula fragment and to displace the astragalus backward a little, which is often missed in the study of the X-ray plate, and disregarded in



Fig. 7

Fig. 8

Fig. 7 (left). Impact splint. Tibia, anterior split. Due to impact with foot in hospital room. Less than in the posterior split.

Fig. 8. Medial view. Fracture an even fracture very rare. Fracture of the internal malleolus. I act on it the fibula is cheap. Not fracture of fibula shows internal stress. This is impression fracture preventing on fundamental of centers from the lateral tip as the height of the fibula fracture is not one to of importance. Out and push from of foot.

treatment. First flex the knee. Rocking the foot usually suffices to correct the lateral displacement but many of these minor posterior dislocations are not reduced. Direct pressure backward on the intact tibia will and a strong pull forward on the tuberosity of the tibia carry the foot into hyperdorsal flexion. By so doing we shall save the patient much subsequent discomfort. With direct pressure we can also correct those backwardly carried inferior fragment of the fibula and this is essential. Twist the foot inward and forward. It twisted outward and backward when it occurred. After reduction there is very little tendency to displacement unless a posterior split has occurred. If the internal malleolus is intact a flexion is the position of choice and may be held by any splint. Personally for the emergency we use a pillow splint tied with tapes and reinforced with pieces of splint wood or board internal external and posterior. Below the foot the open end of the pillow case are folded and pinned so as to keep the foot hyperdorsiflexed. If the position is satisfactory in the X-ray we put on a Castor splint bending the knee always to keep the position of hyperdorsiflexion of the foot. This relaxes the gastrocnemius and soleus muscles,

which form the tendo achillis. A doughnut is placed under the heel at any time. No Pott should be put into place at this time. The swelling is too great and the cast is at any incision under these conditions. If the internal malleolus is broken we do not invert the foot. We use a straight position. Inversion with a broken internal malleolus is an absurdity worse than an absurdity. It is a menace.

Where the internal malleolus is broken and displaced Magnuson of Chicago uses a small incision over the malleolus and puts it back into place with an ivory pin which he leaves. He believes that by this measure he restores the mortise of the joint and that then he can place the foot in the position of inversion. We believe the reduction and the straight position are sufficient in most cases but in a very limited number where reposition of fragment is hard to obtain, this treatment is ideal.

We always have several pillows under the knee to keep it in the flexed position thus rendering the hyperdorsiflexed foot comfortable. Only in those cases showing a large anterior split of the tibia which are rare do we vary the hyperextension of the foot. Even in these cases, we are careful to get the foot at a right angle because we have found that this is one of the movement easily lost by use and slow in recovery. Keep the foot always a right angle with the leg and you will have no difficulty even where there is a tendency to bow the leg on the anterior edge of the tibia. If there is a posterior split of the tibia it is essential to keep the foot dorsally flexed a plantar flexed foot is apt not only to relax but where the fragment is large and involved at least half the articular surface of the tibia but it is apt to push upward the posterior fragment.

Fortunately these posterior split are usually small and do not involve a great articular surface.

We begin motion in most of these cases by the third or fourth day in the ordinary type and certainly by the end of the first week in nearly all of them unless there is tremendous swelling or tremendous tearing of ligament which only happens in the very serious cases.

We believe that if one observes carefully he will be surprised at how rarely this occurs. Every day thereafter the foot is gently moved passively and actively, the hyperflexed foot being carefully lifted from its splint by the toes, the knee kept well flexed. We follow the same manoeuvre in all our cases whether the fibula is broken high up or low down. The broken internal malleolus simply means a greater degree of caution. Plantar flexion must never be carried to extremes. An arc of 30 degrees of motion at first is sufficient.

Dorsal flexion actively and strongly is essential and effort is made by the patient early to dorsiflex his foot strongly except in cases of anterior split. Even here passive flexion within limits is used from the first.

In the case of posterior splits, be especially careful not to plantar flex too quickly or too far. In some few cases of great injury we permit immobilization for 10 to 15 days with the toes free for movement but in most cases we begin motion gently not later than the fourth day. Thereafter motion every day and as passive is to be preferred to immobilization, so active motion no matter how limited is to be preferred to passive motion. Motion must be retained from the first, and can be so retained in practically every case if care and intelligence are used in the manipulation. This is the point of the whole treatment. Restriction of motion—partial ankylosis—is due to organization of inflammatory products and involvement of tendons, and tendon sheaths in the reparative scar tissue together with a traumatic synovitis which is kept without motion. It is remarkable how quickly these immobilized ankles tend to stiffen. It is remarkable how quickly and easily and without pain they take up their functions even in the face of tremendous trauma, if they are given a chance early. Do not let them stiffen. If you do you will have impaired function for a long time.

By the end of the first week, or before in nearly all of these cases, the swelling will be of such a nature that a cast is practicable. It should extend in the simple cases only a short distance up the leg. In the more serious it should reach nearly to the knee.

If the internal malleolus is unbroken the assistant holds the foot by the toes in strong

inversion and hyperdorsiflexion with a flexed knee while we are molding the cast. Get well above a right angle and use a light cast.

The cast is put on over stockinette and the stockinette is not pulled over the foot. It is rolled over thus preventing any undue pressure on the broken malleoli. A few small strips of metal are incorporated under the heel to prevent subsequent breaking and the cast is cut down the front, when sufficiently hard a strip 1 inch in width being removed along the whole length and widened from the ankle for ward to from 1 5 to 2 inches, so as to permit of easy removal. Many of these cases have a molded leather ankle splint by the end of the first week because of its lightness.

After the tenth to the twelfth day all danger of damage to these injured ankles has passed if we use care and all of them are in plaster or molded leather the patient going about on crutches. After the first few days the simple cases are soaked in very hot water once a day and carried through their exercises. We use the same treatment in these cases as we have advocated in Colles fractures for many years but with one difference. We have repeatedly made the statement that an ordinary Colles fracture with anything for retention except a wrist strap after the tenth to fourteenth day was maltreated. We do not mean by that, that a patient who has suffered a Colles fracture can throw a base ball on the fourteenth day or the twenty first, but we do say that there being no weight bearing at the wrist, we may dispense with all restrictive apparatus, except the small leather wrist strap very early. The same would apply to a Pott's except for three factors: the weight bearing, the weight of the foot itself anterior to the astragalus and the pull of the gastrocnemius and solus muscles. These, then must be considered. After the twelfth day there is little danger of redislocation or damage to the broken parts provided we have no weight thrown upon the foot. We cannot permit weight bearing in any of these injuries at the ankle joint due to leverage until there is no possibility that that weight bearing will cause deformity by bending out the bones on the hinge of soft callus which holds them together and we must not permit this until such time



as this soft callus has been replaced by bony tissue strong enough to resist the pressure which it will be called upon to bear.

This is an individual proposition and probably differs greatly in every person so that we must not take chances. One bad result—one foot that turns out progressively after weight bearing—will more than counterbalance good results in a dozen cases. It is probable in fact I am convinced that many of these cases would receive no injury from weight bearing much earlier than we now permit, but where the individual coefficient of repair is an unknown quantity we must not take chances and there is no necessity for so doing. With motion each day by the twenty-first day all these cases will be able to have a practically normal motion at the ankle the simple ones much sooner. The ankle will swell and in some of them cyanosis will be pronounced but they will all have the normal range with perhaps some slight restriction. So long as we preserve this normal motion against the day when we can with absolute safety permit of weight bearing, we shall have done all that is needed to do, since in this case they will be able to walk with ease when the time comes instead of having the recovery of lost motion still before them.

In the simple case of a break of the external malleolus below the joint level there is no tendency to eversion of the foot. Such a case needs practically no restriction except care and may bear some weight with care at almost any time certainly by the twelfth or fourteenth day. A case of simple break of the fibula above the joint by direct violence and not a leverage fracture is held together by soft callus by the twelfth day. There is beginning actual bony growth across the break by the twenty-first day. There is little strain in weight bearing in such a case, and neither does it require a great amount of restriction. By the twentieth day such an injury may safely begin to bear some weight, but care must be observed.

In a leverage fracture of the ankle joint, attended by ligamentous tear and by the potentiality at least of dislocation at the astragaloid joint either by inversion or eversion, with fracture high up or low down of the

fibula by the fifteenth day the foot should be out of the cast for an hour or two each day. It should be soaked in hot water and active motion in flexion and extension should, by this time, reach a fairly normal range. No lateral motions should be permitted.

By the eighteenth day only a light molded leather ankle strap should be used by day the cast being used only at night, but the patient should be permitted to sit with the foot resting lightly on the floor without weight and in the simple cases with a shoe raised  $\frac{1}{4}$  to  $\frac{1}{2}$  inch on the inner side slight weight bearing may be begun by the twenty-first to thirtieth day but no great amount of weight should be borne for at least 4 or 5 weeks. We must remember that with this treatment when he begins to bear weight, the surgeon has finished the case, and we can therefore afford to go slow. There are no long months of struggle before him for the completion of motion.

In the serious cases it is better to wait 6 weeks before weight bearing. It is safer to do so and there is little to be gained since the motion has not been lost. In the serious cases with great injury and dislocation where the man is very heavy a steel support attached to a padded ring on the leg and inserted into the heel of the shoe may be used for several weeks after walking is permitted but in the vast majority of cases, this will not be found necessary. The inverted foot and the ankle strap will be sufficient. A leather or a metal foot plate is sometimes added.

The inferior calcaneo-caphoid ligament, the spring ligament which is one of the important ligaments of the internal longitudinal arch is rarely injured but all muscles and ligaments are weak from disuse after a fracture of this kind. It is sometimes, important to wear a foot plate but it is of far greater importance to put the injured foot through a period of regular exercise before weight bearing is permitted. This is the treatment which should be used in every case of fracture of the ankle and if used will shorten the time of disability by months. It is unfortunate that in the unintelligent class of people, care will have to be used, and the casts left on for a longer period because they cannot be trusted, and damage suits are at present far too common to be

## 249 ANKLE INJURIES—ALL KINDS EXACTLY

## AS THEY CAME

I		Cases	Per cent
Fibula alone		38	55.4
Broken high			4.8
Half way		7	8
Clearly at joint or near it		105	48
Peroneal tears from eversion		4	5.6
Ankle dislocated at joint		20	6
6 of whole or broken	per cent of number with fibula		
II		Cases	Per cent
Fibula and internal malleolus		5	20.9
Fibula broken			
High		6	6.4
Half way			4
At joint or near		34	3.6
Peroneal tear			4
Internal malleolus broken			
At joint level		45	8
Low		7	8
Dislocation of ankle		34	3.6 of
hole series or 65.4 per cent of this class			
Internal malleolus displaced anteriorly		3	9
III		Cases	Per cent
Internal malleolus alone		35	14
At the joint level		26	1.4
Below half		7	8
Peroneal tear			8
Dislocation of foot			4.8 of
whole or 34.3 per cent of this type			
Internal malleolus displaced forward indicating eversion		3	5
IV		Cases	Per cent
Fractured fibula and separated tibial epiphysis		5	
Dislocated foot		4	
V		Cases	Per cent
Fractured scaphoid, alone		2	8
As complication		2	
VI		Cases	Per cent
Fractured astragalus, alone		3	
As complication		2	
VII		Cases	Per cent
Fractured scapula		3	
VIII		Cases	Per cent
Dislocated foot without fracture		3	
Fore and			8
Outward with ligament rupture			4
IX		Cases	Per cent
Impact splits of tibia, alone		4	6
As complication		28	
X		Cases	Per cent
Total dislocation of the ankle all cases		27	34.9

## VI

	Cases	Per cent
Clearly eversion fractures	34	3.6
Peroneal tears of fibula	14	5.6
Peroneal tear fibula and broken internal malleolus as well		4.4
Broken internal malleolus, alone	8	3
Broken astragalus from impact in eversion		8
Broken fibula and internal malleolus		3.6
Fibula high	9	
Fibula at joint	3	
Ruptured inferior tibiofibular ligaments clearly as evidenced by wide separation of the bones in the X-ray plate		30 cases, 05 per cent
Many others undoubtedly were ruptured but when the X-ray evidence was not conclusive they were excluded		
disregarded but even in this case, where the casts (for reason of prudence) must be left for a much longer time than necessary it is incumbent upon the surgeon to see that the mobility of the foot is preserved from the first.		
In the eversion type we always use a shoe which is made so that the inner side of the heel and sole make a straight line, as all shoes should be made and long enough to sweep wide of the toes.		
The inner side of the heel and sole are raised $\frac{1}{4}$ to $\frac{1}{3}$ inch in order to invert the foot slightly. An inverted foot is always a strong foot, an everted one is always a weak one.		
CONCLUSIONS		
Leverage fractures of the ankle under compression are in reality all of the same etiology and vary simply from distribution of force and intensity of stress. This applies to most of the so-called simple fractures of the lower end of the fibula since the salient features of this fracture are present i.e. ligamentous and tendon injury and a destroyed mortise permitting dislocation. Simple fractures of the fibula at any level the result of direct violence without ligamentous rupture do not belong to this type, but there are no compression leverage fractures of this kind involving the ankle joint.		
The inversion types are not usually attended with so great a destruction of ligaments, but there is an equal or more serious involvement of tendon sheaths and a greater posterior dislocation is common in our experience.		
The majority of these fractured ankles are not tremendously serious injuries and do not deserve the bad repute which is theirs at		



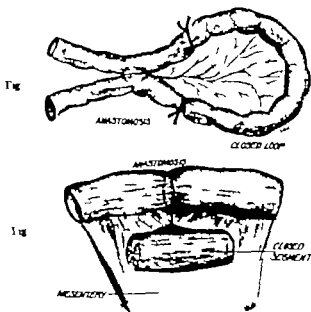
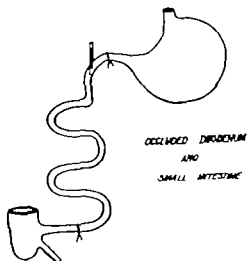


Fig 1 and 2 The anastomosis of obstruction



*a Distention* This was produced by active secretion or by venous stasis from interference with the blood supply. The stasis came into play repeatedly in the closed segment obstructions where the segment was suspended by a long mesentery.

*b The action of retained digestive juices* In 34 cases of the various obstructions the average time before death in closed segments in the lower ileum was 42 hours. In closed duodenal segments death followed in 48 hours. That death was more rapid in the ileal segments than in the duodenal may be explained by the longer mesentery in which venous stasis could more easily occur and also the addition of bacterial infection invading the peritoneal cavity. In one closed loop in the duodenum the time was 7 hours, and in one closed loop in the lower ileum 144 hours. In the closed loop group only two dogs died and eight recovered. In these cases the obstructed area was held by the bowel preventing any interference with the blood supply. The average time in total occlusion was 72 hours. When the most fatal obstruction was a closed ileal segment and one of the least fatal a total occlusion involving the entire duodenum and most of the small intestine, one could hardly say that the lethal factor was a toxin formed in the mucous membrane which is brought into activity by the obstruction in the form of a secretion, and the only explanation seem to be that the toxin was formed

by the breaking down of necrosed tissue. In one case of total occlusion the upper ligation was below the pancreatic ducts. This dog died in about 40 hours and at postmortem the liver presented a most stinking appearance. It was small and covered with small white necrotic areas. There was some necrosis of the pancreas. The blood was observed to look more like bile than blood. Evidently there was a backing up of the secretions which accounted for the extensive necrosis. Figure 4 shows the necrosis of the liver. This section seems to rule out the possibility of any absorption of toxins through the blood stream for if that were the case the necrosis would have commenced in the portal branches around Glisson's capsule.

Figures 5 and 6 show the mucous membrane of obstructed areas in dogs which recovered. There is an absence of necrosis. Figures 7, 8, 9, and 10 are from dogs in which the obstructions were fatal. Here extensive necrosis is seen. It is due to a cause acting from the lumen of the intestine. This destruction of tissue means that there are innumerable lacteals and lymphatics opened up making a very direct path for the absorption of any toxins within the lumen of the bowel. Figure 11 is from a dog which died of intussusception developed after it had recovered from an experimental obstruction. Here again the necrosis of the mucous membrane is very evident.

## THE PATH OF ABSORPTION OF THE TOXIN

That death in thrombosis or embolism of the mesenteric vessels is due to the absorption from the gangrenous tissue can hardly be disputed, but how can absorption occur through obstructed blood vessels? The absorption is through the lymphatics, the third circulation, which makes gangrenous areas so fatal when occurring in tissue richly supplied by them. In one dog a 6 inch segment of the lower ileum was tied off with tapes and the blood supply ligated to the mesentery. In 24 hours the dog was dead, and the segment was found black, about as thin as paper and shriveled up to about one-quarter normal size. It was lying free and not adherent to any other structure. The fluid in that gangrenous area could have been absorbed only by the lymphatics which had been left intact. An opposite picture was seen in another dog in which an area was obstructed and not only the blood supply but also the lymphatics were occluded. In 24 hours this dog was alive, not toxic, and the obstructed area was about four times normal size and filled with bloody fluid. Until it ruptured this obstruction was not fatal because the lymphatics were blocked. When the blood supply to a part is cut off but the lymphatics left intact there is still a suction on the lymphatics and any fluid present will be absorbed by them.

There were many little features of the experimentation which have thoroughly shaken the theories of absorption from the intestine and peritoneal cavity and if I may digress for a moment one instance may be of interest. During an operation the thoracic duct had been opened in the neck and there was a moderate flow of lymph which rapidly coagulated. The abdomen was opened for the production of an obstruction. A duodenal tube was passed into the lower part of the duodenum and a quantity of tap-water passed through the tube. There was almost an immediate rapid increase in the flow of lymph until it was about three times the former flow. I had never seen such a copious flow and the lymph became thinner so that it failed to coagulate. On a later occasion a similar procedure was carried out and the carotid artery was attached to a kymograph. When water was introduced into the duodenum there was again a rapid increase in the lymph flow without any alteration in the blood pressure. In another dog the abdomen had been opened and a ligation of the appendix done. The abdomen was closed and when, immediately later, the thoracic duct was exposed and opened it drained bloody chyle very freely during the whole of the operation. The blood was absent from the duct

drainage several hours later and it was assumed that some coagling of blood had occurred into the peritoneal cavity when the abdomen had been opened and it had been absorbed directly into the lymphatics. These findings are evidence of a free communication between the lymphatics and the lumen of the bowel in the one instance, and the lymphatics and the peritoneal cavity in the other.

Working on the theory that toxic absorption takes place through the lymphatics, the thoracic duct was drained in the various forms of obstruction. Brief summaries of several of the experiments show the striking results obtained.

Dog 3. Ether anesthetic. A 6 inch closed segment of the lower ileum was produced and an end-to-end anastomosis was done between the divided end of the ileum. The thoracic duct was then drained. On the third day there was evidence of diffuse peritonitis but the thoracic duct failed to drain successfully and these symptoms subsided. On the seventh day the dog, as rapidly coming to normal. The abdomen was again opened under ether and sub-joining peritonitis found. The segment had ruptured in its places. It was removed and the dog recovered.

Dog 4. The same procedure was carried out. The duct failed to drain and the dog died in 45 hours. There was beginning diffuse peritonitis, and the segment had ruptured as in Dog 3.

Dog 5. The same obstruction as produced but the duct was not drained. The dog died in about 48 hours. There was diffuse peritonitis and the segment had ruptured as in the other dogs.

Dog 6. Obstructed just beyond pylorus and about 6 inches above the cecum with double strands of chromo-catal. Drained the thoracic duct.

Dog 7. On the same day obstructed as in Dog 6 but did not drain the thoracic duct.

On the fourth day the dogs were again anesthetized and the abdomen opened. In Dog 7 the obstructions were still complete. The intestine looked healthy and as practically empty. The obstructions were relieved and the abdomen closed. In Dog 6 the obstructions are complete. The intestine was filled with fluid contents, deeply congested throughout and the lower end markedly distended and crying on gangrene in number of areas. The obstructions were relieved and the abdomen closed. Dog 7 made a satisfactory recovery and Dog 6 died the same day.

From the experiments the following conclusions were drawn:

1. Toxicity in acute intestinal obstruction is due to the absorption of toxins formed from necrotic tissue.

2. When in total occlusion the upper obstruction is just below the pancreatic ducts there is rapid necrosis of tissue above the obstruction and death, but when the obstruction occurs above the ducts just beyond the pylorus even though more area is obstructed the accessory gland digests juices, and especially that from the pancreas, are neutralized lower down and necrosis and death are considerably delayed.



Fig 4



Fig 5



Fig 6



Fig 7



Fig 8

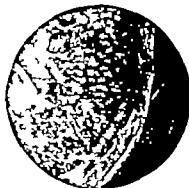


Fig 9

Fig 4 Shows necrosis of the liver  
Figs 5 and 6 Sections showing the  
mucous membrane of obstructed intes-  
tins in dogs which recovered

Figs 7, 8, 9, and 10 Sections from  
dogs in which obstructions are fatal  
Fig Section from dog which  
died of autonecropsion developed after  
it had recovered from an experimental  
obstruction. The necrosis of the mu-  
cous membrane is very evident



Fig



Fig

3 The absorption of toxins is through the lymphatics to the thoracic duct

The practical application of these findings to surgery has not been worked out. Merely touching on their bearing on surgery one may say that they call for the withholding of fluids by mouth, dehydration being combated by intravenous infusions. They indicate that in all operative

procedures the lymphatics should be taken into account and to prevent a continuation of the absorption of toxins in some obstructions it may be necessary to supplement the relief of the obstruction by a lymphaticostomy. Should this be done the continual administration of water through a duodenal tube will help to keep a constant drainage from the duct and prevent blocking

# LYMPHATICOSTOMY IN PUERPERAL INFECTION

By A. C. EDWARDS, M.D. PARAGON WISCONSIN

FROM three immemorial medicine has been battling with the condition or conditions known as puerperal infection. Giant strides have been made especially since the time of Oliver Wendell Holmes and Semmelweis who proved beyond doubt the infectious origin of the disease. Their studies and conclusions undoubtedly lessened the percentage occurring in hospital practice but in general work the condition remains about the same as it has for centuries. Von Bonney (1) states Sepsis accounts for between 30 to 35 per cent of total deaths during the puerperium.

Doederlein (2) classifies puerperal infection into the following:

1. Ascending type—through natural channels
2. Descending type—through blood stream and by contagium

The ascending type is by far the more frequent begins by wound infections and may be due to the following organisms named according to Williams (7) in the order of their frequency: (1) streptococcus, (2) staphylococcus (3) gonococcus (4) bacillus coli communis, (5) bacillus aerogenes capsulatus, (6) pneumococcus.

While in the milder types the infection remains localized in the genital or generative organs, a large percentage become systemic in character due to absorption through the blood stream and lymphatic channel. Those which localize and are treated surgically recover in nearly all instances. Those which become systemic show a mortality rate between 25 to 40 per cent death usually being caused by exhaustion and toxemia of puerperium.

It has been proved that probably the majority of systemic puerperal infections originate from lymphatic absorption. Edgar (4) states: "The genesis of puerperal infection in the puerperium is the lymphatics—the bacteria passing from the lymph spaces of the uterus directly into the peritoneal cavity." Southard and Canavan (5) state: "The puerperal infection probably surmounts the intestine in supplying regional lymph nodes with bacteria. They found in 15 out of 20 cases postmortem with pelvic lesions micro-organisms in the pelvic lymph nodes."

The treatment of these systemic infections has been mainly medical with the evolution of a hands-off policy. Doederlein states: "Abdominal operations in the ascending type without occlusion are out of the question." Watkins (6)

states: "As the disease is chiefly systemic, treatment is essentially general. The important part of the treatment of puerperal infection is the use of remedies to increase the body resistance and the abandonment of measures that interfere with the development of immunizing substances." Costain (2) in a recent article states: "Absorption from the peritoneal cavity takes place largely through the lymphatic system and one of the most helpful procedures in relieving the toxemia is through drainage of the left thoracic duct."

In support of his contention, I wish to present the following case:

Mrs. M. K., age 27, entered St. Mary's Hospital, May 1, 1915, with the following history: The father is 41, is alive and well. The mother, 40, is alive and well. She has 3 brothers and 2 sisters, alive and well. Patient had measles and chicken pox, her child, both followed by full and uneventful recovery. Menstruation began at 13 years, has always been regular and free from pain and cramping at her first pregnancy.

Previous illness: Delivered April 4, 1915, on labor for 6 hours, but delivered without instrumental assistance—second degree tear of perineal body and some lacerations of cervix which were not repaired. She felt fine first 48 hours, then had a chill followed by fever, when they called another physician, he examined her April 9, 1915, with the following findings: Dilated cervix, lacerations of cervix and perineum, slight amount of foul smelling vaginal discharge, but pneumonia of right base. Temperature declined by 1 day and she was supposed to be free from fever from May 4 to 8, although husband states she does not feel at all well during this time. On May 8 she took and died during the night with chill—crampy pains across lower abdomen which were accompanied by nausea and vomiting. On May 9 her seen by her physician, she had temperature of 104—generalized tenderness over entire lower half of abdomen and profuse vaginal discharge. She entered hospital on stretcher May 10.

Physical examination: Patient is female of moderate stature, poorly nourished, with typical hyperpycnic facies. The scalp is negative. The eyes react to light and accommodation. The teeth are in good condition. The tongue is dry and furred. The chest has moderate enlargement of thyroid. The chest is sensitive except for few coarse rales over the right base. Heart apex at fifth intercostal space, no demonstrable murmurs present. Pulse very fast, quality poor and equal in both arms. Blood pressure 110/70. There is liver dullness from fifth rib to costal border. The abdomen is markedly distended, the bowel coils perceptible on inspection, and tympanic throughout. Moderate tenderness is present over upper abdomen but extremely so over hypogastric and both inguinal regions. A rectal examination shows second degree tear in perineal body, the parts are bathed in pus as there are some small lacerations of the cervix. Internally the uterine body is large and boggy, the posterior surface raw and hard to touch, and there is no demonstrable fluctuation. The tubes and ovaries are not palpable but marked tenderness is present over both regions.

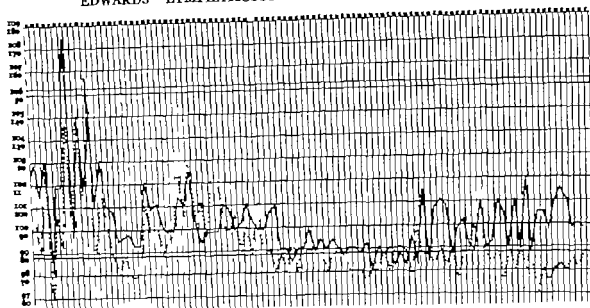


Chart Pulse and temperature curves 4, Four hundred cubic centimeters citrated blood transfused, lymphaticostomy Pulse—temperature

**Laboratory findings:** White blood cells, 5,000, differential polymorphonuclears 95 per cent, small lymphocytes, 3 per cent large mononuclears, per cent, red blood cells, 3,350,000 hemoglobin 57 per cent color index, 8 per cent. Urine from catheterized specimen shows specific gravity 1.020 and trace albumin no sugar. Microscopic examination shows few hyaline and granular casts, erythrocytes with some pus cells and bacteria. Stained smear from cervix showed some extracellular gram negative cocci with some pneumococci.

**Diagnosis:** postpartal sepsis with general peritonitis. Course: May 2, 1933. Patient gives 500 cubic centimeters of per cent glucose intravenously. This is followed by chill lasting 30 minutes. The abdomen is badly distended, tympanitic throughout and general condition about same as yesterday. Blood culture taken.

May 3, 1933, 8 a.m. General condition seems some better. She has no pain tenderness on palpation is not so marked, there is no vomiting and no dullness in flanks. Five hundred cubic centimeters per cent glucose was given intravenously followed by slight chill lasting 5 minutes. 5 p.m. intravenous glucose repeated with condition about same as in morning. White blood cells, 27,000 polymorphonuclears 95 per cent, small lymphocytes, 4 per cent, blood type 4. Needle inserted into lower right pleural cavity and into liver region with negative results.

May 3, 1933, 5 p.m. Patient given 400 cubic centimeter citrated blood—donor and recipient being same type. She had severe chill lasting 30 minutes but reacted all in spite of her poor condition.

May 4, 1933. Condition about same. White blood cells, 24,000 polymorphonuclears 90 per cent, small lymphocytes per cent. Operation under per cent novocaine. A 3 inch incision was made over the posterior border of the sternocleidomastoid on the left side. Blunt dissection was carried down to the internal jugular vein on separation from its sheath and traction medially presented the thoracic duct which was opened and drained after the method of Costan. Culture and smears are taken from thoracic

fluid. Skin and fascia were closed with interrupted silk worm and hot hydrochloric dressing applied. Dressing was changed in afternoon, drainage profuse. Blood culture negative.

May 5, 1933. The abdomen is much softer there is no rigidity some decrease in size but there is profuse drainage from neck. Four hundred fifty cubic centimeters per cent glucose was given intravenously followed by no chill.

May 16, 1933. Condition seems better profuse drainage from neck, neck removed. White blood cells, 43,000 polymorphonuclears, 95 per cent, small lymphocytes, 3 per cent, large mononuclears, per cent red blood cells, 3,33,000 hemoglobin, 80 per cent color index, per cent.

May 7, 1933. Drainage not so free, abdomen markedly decreased in size, no areas of tenderness or rigidity. Patient doesn't appear nearly so toxic, the tongue is moist, the extremities warm. She was given 500 cubic centimeters of glucose. The pulse is regular and of good volume. Smears from the thoracic fluid show gram positive diplococci (probably pneumococci). White blood cells, 33,400 polymorphonuclears 90 per cent small lymphocytes 8 per cent large mononuclears, per cent.

May 8, 1933. Drainage from neck very much reduced. The abdomen is nearly normal in size with no areas of tenderness or rigidity. Examination of culture of fluid from thoracic duct reveals pneumococci.

May 22, 1933. Patient is steadily improving, has no neck drainage, tympanites are nearly gone. She is hungry and is allowed semi solids, is not nauseated, does not vomit.

June 4, 1933. Patient feels fine, the neck wound is gradually healing in by granulation. The abdomen is soft with no areas of tenderness.

July 4, 1933. Discharged. The neck wound is entirely healed, the abdomen shows no distention areas of tenderness. Vaginal examination shows some discharge. Binocular examination shows body of uterus contracted and freely movable with no pain on pressure over either the tubes or ovaries which are not palpable.



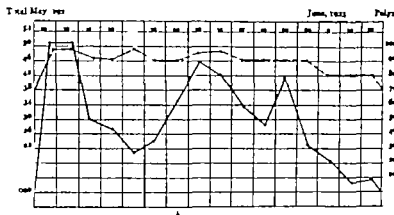


Chart. Total leucocyte and polymorphonuclear counts. Four hundred cubic centimeters extracted blood transfused.  $\Delta$  Lymphaticostomy. Leucocytes — polymorphonuclears — — — — —

July 27, 9:30. Patient feels well. She complains of no pain or distress of any kind. The abdomen is negative on examination. There is small amount of normal discharge. Bimanual examination shows the uterus body small and freely movable. No pain or tenderness is present on pressure over the tubes and ovaries of either side. Blood examination: white blood cells, 7,600; polymorphonuclears, 7 per cent; small leucocytes, 1 per cent; large mononuclears, 3 per cent; eosinophiles, 3 per cent; red blood cells, 3,544,000; hematoglobin, 63 per cent; color index, 0.9 per cent.

#### CONCLUSIONS

1. Recovery of the same type of organism from both cervical canal and thoracic fluid proves that a great deal of absorption takes place through the lymphatic system.

2. Lymphaticostomy is a relatively harmless procedure.

3. Drainage of the thoracic duct does relieve the toxemia and in conjunction with other measures is a useful adjunct in the treatment of systemic type of puerperal sepsis.

I wish to express my sincere thanks to my associate Dr. R. D. Thompson, to Dr. C. I. Myers, and to the Sisters of St. Mary & Raphael Hospital, for making it possible for the presentation of the foregoing article.

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THE ISOLATION OF THE SUBMUCOSA AS AN AID IN INTESTINAL ANASTOMOSIS<sup>1</sup>

By A. J. GRAHAM, M. D., F. A. C. S., CHICAGO  
From the Department of Surgery, College of Medicine, University of Illinois

THE purpose of this paper is to show the part played by the submucosa in the development and performance of enterorraphy to explain, by directing attention to its physical properties, certain measures that are now being taken, such as walling off infected areas with bowel and to suggest further utilization of this membrane.

The existence of the submucosa as an entity has been known many years but an appreciation of it in intestinal suturing has not been sufficiently dwelt upon, the task being left for the individual surgeon to work out for himself. This lack of clearness was due, in part to the older histologies, such as Stricker's (1) 1872 describing the bowel wall as consisting of two tubes, (1) mucous and (2) muscular. Its location and character were mentioned but no idea was given of its appearance as isolated; it lost its identity in the mucosa. The sliding of coats, or eversion of mucous membrane at operations occurs between the submucosa and muscularis. It was formerly customary to speak of the everted portion as mucosa, and thus the submucosa was lost sight of.

## HISTORICAL

To understand the development of this appreciation of the submucosa, it is necessary to review the estimates put upon it by surgeons of the past in intestinal anastomosis.

Lembert (2) in 1826 showed that healing must be by peritoneal approximation, and described the plastic lymph which seals the joint. His stitches penetrated "as far as the mucous membrane. Operators of that day thinking of the eversion of the mucous membrane and of the two tubes often missed the submucosa entirely. Lembert said that his stitches encysted and were not sloughed into the lumen of the bowel. The researches of Schmidt, Thompson, and Travers soon afterward, however, showed that stitches as foreign bodies were cast off to the lumen of the bowel.

Fifty years later or after abdominal operations were becoming more frequent, Czerny (3) in 1881 wrote: "In order to prevent the escape of intestinal contents and to place the parts in an ideal condition for repair, he caught up the mucosa and (submucosa) in another row of stitches."

Lister (4) in 1881 first described the isolation of the submucosa, and brought the first notice of it to surgery by the following description:

Catgut, as you are doubtless all aware is prepared from the small intestine of the sheep. The gut is treated in what seems an exceedingly rude manner for so delicate a structure. It is scraped with some blunt instruments such as the back of the knife over a board and by this means, as the people express it, the dirt is scraped out. That which these people call the dirt is the exquisite and complicated structure of the intestinal mucous membrane. But while the mucous membrane is scraped out from within, there is also scraped off from without the circular coat of muscular fibers. The result comes to be that the intestine is converted into a comparatively unsubstantial material consisting of two parts or bands one more slender than the other. When the mesentery is stripped off by the butcher the peritoneal covering of gut shrinks into a narrow strip and thus, with some of the longitudinal fibers constitutes the more slender of the two parts to which the intestine is reduced by this process of scraping. The



Fig. Photograph of catgut casing. Observe its deviations under the blood vessels.

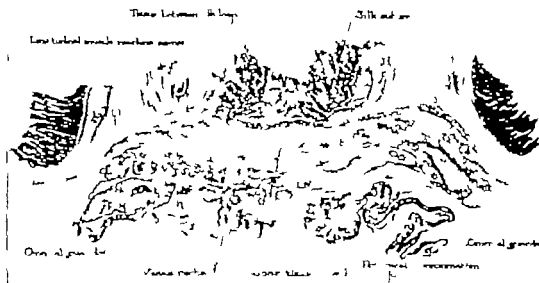


Fig 2. Five day joint. Not loops of silk showing out the reaching across of longitudinal muscle scar tissue holding the joint. At this time remains of two vasa recta which were placed side by side at the operation and the serosal guards.

other part is the essential material from which catgut is prepared, and this is neither more nor less than the submucous cellular coat of the intestine. When I first visited a catgut manufactory I was astonished to find that after this scraping process, the intestine could be blown up still as a continuous tube, as you see can be done with this specimen which has been treated in the manner I have described. This exquisitely delicate structure is a beautiful anatomical preparation of the submucous cellular tissue though made in so rude a fashion. This coat of the intestine, which in the sheep has this extraordinary toughness is the material out of which catgut is prepared.

Bacteriology at this time cleared up the question of external sepsis so that causes of failure could be understood.

Mall (5 6) demonstrated in 1887 the reticulated tissue in the stratum fibrosum.

W S. Halsted (7) in 1887 and working later with Mall, isolated the submucosa and described it as air-tight and water tight. Employing needles with dulled points he proved that sutures with a grasp of the serosa and muscularis only were not to be trusted (Exp A, Halsted 7). He insisted that each

stitch should include a bit of submucosa and stated, I am not aware that the importance of this coat has been hitherto emphasized. Again in 1891 he wrote "Success depends upon an appreciation of the importance of the submucous coat of the intestine," and that it was "remarkable that surgeons could have overlooked the existence of the submucosa and again, "About 3 years ago I endeavored to emphasize the importance of the submucous coat in operations, but succeeded only in attracting attention to the quilt or square stitch. He feared then the entrance of the stitches into the lumen, and thought the stitches encysted, or sloughed to the serosa.

M E Connell (9) in 1893 "in order to reduce the number of stitches and knots" devised the continuous mattress suture.

Murphy (10) in 1892 with the button demonstrated how quickly the intestinal coats healed (alluded to by Moynihan later). According to Barbat (11) the button pushed all the tissues out of its grasp except the submucosa and peritoneum.

Senn (12 3) in 1893 wrote "Halsted's advice to include in the stitches the firm fibers of this submucosa, is important and should



Fig 3 Nine day joint a, silk loop b ulcer closing c, valve rectus crusting



Fig 4 Sixty one day joint—delayed union. limits of epithelium closing over b pyramid of crustal silk cavity c, dense scar tissue

never be ignored and speaking of the Czerny Lambert method said the inner stitches ulcerate into the bowel the outer ones become encysted

Edmunds and Ballance (14) of the Brown Institution, London, in 1896 quoted Lister's description of the isolation process and showed that the sliding of the mucous membrane over the muscles took place between the submucosa and muscularis. They used both Lambert and Halsted stitches and proved that both sloughed to the lumen of the bowel. They thought it remarkable that in Mammell's operation the circular suture of through and through unabsorbable material should leave fewer signs, in a given time than the Lambert stitches in the longitudinal slit.

Spalteholz (16) in 1897 described the connective tissue framework of the mucous membrane of the small intestine of the dog as consisting of a dense network of reticulated collagenic and elastic tissue

H. A. Kelly (17) in 1898 wrote that "the most valuable contribution which has yet

been made to intestinal surgery is the demonstration by Dr W. S. Halsted of the fact that the essential feature in any suturing or anastomotic operation is the employment of the submucous intestinal coat, and referred to its other applications by comparing the relative thicknesses of the submucosa in the large and small intestines as being of the ratio of 4 to 1 respectively and by utilizing the sigmoid in walling off pelvic infections by placing it around the brim of the pelvis

#### OBSERVATIONS AND EXPERIMENTS

In an attempt to secure for the students in the College of Medicine of the University of Illinois the appreciation of the submucosa in experiments in intestinal work, as well as to investigate its physical properties its study and isolation were begun

In the first place everything made from the submucosa was secured from the packing house, as catgut, tennis-racquet and violin strings, and Cargile membrane (derived from the trachea and now called Allison-Brooks

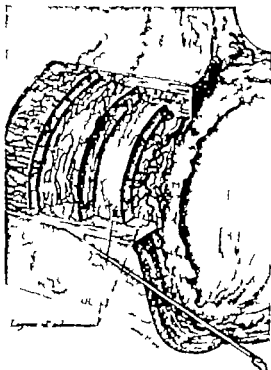


FIG. 5 The coats in echelon with needle applied for the Lembert stitch and controlling hemorrhage

membrane) The manufacture of most of the articles was observed. This gave an entirely different view of the relative strength of the various layers of the bowel wall and it was readily seen why some stitches pulled out, and why care was necessary in taking the Lembert stitch.

The submucosa was studied in six ways:

1 *Raw boards* Sections of beef bowels were used in practicing the fundamental stitches and in making unions. Fortunately at one of these periods sausage casings were sent, and the students were obliged to familiarize themselves with this vital layer—the submucosa.

2 *Dogs* Experiments on dogs were made as follows. The submucosa was exposed by removing the overlying coats at the pylorus and at various places in the small bowel the muscles being the easier detached as the ileum was approached.

3 *Excursions* The class was taken to the

Chicago Stockyards for it is only from watching the packing-house prepare sausage casings and catgut that this tissue assumes its identity. There after macerating the bowel in water for a time it is pulled through the slimer which removes mucosa, muscles and peritoneum leaving the submucosa, a slender translucent shred or a casing for sausage (Fig. 1). That it is a permanent layer may be seen as it deviates under a blood vessel as a subway runs under a river leaving the course of the vessel outlined as it branches toward the antimesenteric border.

It will prove highly instructive as well as a time saving process, for the surgeon to visit an abattoir and see the bowel macerated and stripped. Afterward he will not allow the submucosa to slip from his line of suturing, as sometimes happens in practice on animals. The unpleasantness of this work in their attainment of asepsis has kept surgeons from this study heretofore. They should see (1) the maceration and stripping of the muscularis and mucosa (2) the distention of casings with water and (3) the spinning of the submucosal strands into catgut.

4 *At operations* Dr Alfred A. Strauss in demonstrating operations for pyloric stenosis, pyloric closure and repair of ulcers, made the following manipulations: (1) He stripped the muscularis from the submucosa in very much the same manner as one would peel a banana (2) he threw a band of rectus fascia between the submucosa and muscularis at any point desired for a closure of the lumen, at the pylorus or elsewhere (3) he even patched with rectus fascia the opening made by a gastric or duodenal ulcer. The submucosa formed the buttress of his suture spans. In all this the thing that impressed me was the way the submucosa stood out as the "skeleton" of the bowel structure. The conclusion followed that this tissue was not sufficiently emphasized in abdominal surgery.

5 *Microscopic comparisons.* Histological sections of sheep gut were compared with its product catgut, teased out and stained that of normal hog gut with its product sausage casing, stained noticing that in the hog gut aside the submucosa almost loses its identity as a layer under ordinary staining methods.

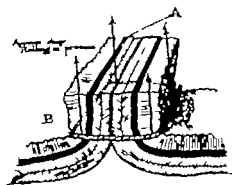


Fig. 6 Typical stitch with submucosa emphasized. Diagrammatic showing the rolling in process.

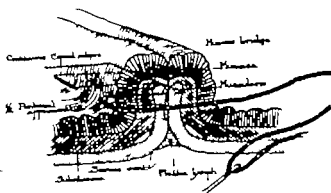


Fig. 7 The continuous Connell suture showing grasp of submucosa and approximation of peritoneum.

**6 Regeneration of layers** To verify the permanency of its tissue by the slowness of its regeneration, junctions of the jejunum in the dog were made. Sections were made parallel to the lumen of the bowel; the fate of the silk sutures noted over periods of 5, 7, 9, 31, 59, and 61 days and the regeneration of layers traced. The silk fibers swelled up and yielded easily to the sectioning knife in any plane. The silk particles of some of the later joints seemed hard and brittle, taking the stain badly and breaking up on the edge of the knife. The silk always acted as a foreign body as shown by its migration toward the mucous membrane to be cast off (Fig. 2).

The silk loop was almost sloughed out in 5 days, the scar tissue holding the joint but fragments of silk were found as late as 31 days. In the 59 day joint the site could only be identified microscopically by a few inflammatory cells and by one layer of the muscularis mucosae being somewhat thickened. Of course the submucosa was completely regenerated (Figs. 3 and 4).

#### PROPERTIES OF SUBMUCOSA

From these and other sources the submucosa may be described as follows: Isolated it appears as white translucent strands.

**Histology** Carey (18) tells us that the submucosa is arranged in two spirals, the inner one making a complete turn in 0.5 to 1 millimeter and the outer one in from 4 to 10 millimeters. The submucosa takes only the diffuse stain which accounts for the fact that

the student loses sight of its importance surgically. He should recall from histology white fibrous connective tissue and then examine the drawings of reticulated tissue for doubtless the makeup of the translucent strands is composed of (1) the reticulated collagenic and elastic tissue of the connective tissue framework of the mucous membrane, (2) the muscularis mucosae and (3) the submucous fibrous and elastic tissues.

**Strength** Goldbeaters skin, a derivative of the peritoneum which is a much thinner structure than the submucosa, in books of 1,000 leaves making 1 inch in thickness, withstands the beating of a 6 to 16 pound hammer 10 hours a week for a period of 2 years—a test of its permanency—yet it will tear in one direction as easily as paper.

**Thickness** The tracheal submucosa (wheat) varies from one-sixteenth to one-hundredths of an inch—the thinnest Cargile membrane. It would probably grade for the different organs as follows: trachea large intestine, small intestine, ureter, fallopian tube, pelvis of kidney, gall bladder and gall ducts.

**Resistance to the needle** As the needle engages it in taking the Lembert stitch, a point ahead of the needle where the blood is pressed out of the muscularis and serosa forms the white ischemic spot. It should give the resistance of rubber dam. A pause should be made to get these tests in taking the Lembert stitch, and the needle not be rapidly thrust through the bowel as a Hagedorn is entered through muscle or fascia. Practice only will

educate the operator as to when and how his needle penetrates the submucosa (Fig. 5)

*Permeability a. To gases.* Goldbeaters skin is the only known membrane that is impermeable to hydrogen gas for any length of time hence its use in airships. That the bowel wall has such powers is evidenced by its being capable of retaining gas under the enormous distention of tympanites in certain cases of obstruction.

*b. To liquids.* Normal salt solution easily passes by osmosis through the sausage casing.

*c. To bacteria.* The membrane is not permeable to most bacteria. Bacteriologists tell us that the lymph glands on the mucosal side are practically always infected, and the fact that peritonitis is not more frequent proves what a barrier the submucosa is. Rammstedt, in his operation for congenital pyloric stenosis took a forward step when he relied upon the submucosa to keep back the bacteria from the peritoneal cavity with the assistance only of the overhauled omentum.

*d. To toxins.* The membrane is not permeable to toxins of large molecular size. It will retain the ptomaines in an obstructed loop or in ptomaine poisoning, and even fatal cases are accompanied by a very tardy development of peritonitis. That it acts as an obstruction to drainage is shown by the more frequent practice of opening infected loops in obstruction. Sala (19) had 7 such cases. And to avoid such a condition surgeons, fearing the effect of such retention and pressure on the junctions, are opening the bowel to the exterior below (Hohlen, 20). Where patency of the bowel can be demonstrated, it seems that the making of an artificial fistula is indicated. Natural fistulae are certainly rare compared with the number of cases of peritonitis.

The function of the submucosa is, therefore three-fold. It is (1) connective (2) supportive the skeleton, and (3) retentive. These functions are recognized by the resistance to pathological processes, the rarity of fistulae, and the slowness of regeneration. It is retentive to gases, bacteria and toxins, as in obstruction from tuberculous peritonitis with enormous distention, or to ptomaines developed from poisoning or from an obstructed loop.

Applying this impermeability to the wall-

ing-off process, Privat (21) in 1846 not being satisfied with Lembert's method closed four perforations of the intestine by suture. When this failed he secured closure by placing an adjacent healthy loop against each perforation, and concluded that that was a better method than suturing.

The absence of the submucosa in the uterine mucous membrane is a factor in the explanation of the immunity of the pelvic peritoneum.

### RESUMÉ

Returning to the part played by the submucosa in intestinal suturing, Figure 6 represents diagrammatically a unit or typical stitch of the Connell mattress suture. Lifting up the everted mucosa and submucosa, the latter presents as a pale, shining membrane like the raw side of leather (landmark). The needle penetrates the united coats, catches the retracted muscles, secures peritoneal approximation with the opposite side picks up its submucosa, passes over a space of mucous membrane, and returns to near the point of entrance, and is tied. The connective tissues form two splints *a*, layers of submucosa, and a bandage *b* (suture material) compressing the soft yielding tissues, the glandular mucosa, the vascular muscles, and peritoneum (Fig. 7).

The method of union is very simple as shown by Moynihan (22) as follows. "But I still think that the great virtue of the button (Murphy) was not in its own use, but in the convincing demonstration it gave to the essential simplicity of the process of visceral union. By using the button we learned how safely and how rapidly the peritoneal junction took place; there was no need it was now perfectly evident, for the hundreds of stitches that all surgeons were using. Firm, even approximation for a very few days would lead the button showed beyond a doubt, to permanent and secure fusion of the apposed viscera.

The intestine is very vascular as a tissue, with free longitudinal anastomosis in the submucosal vessels. Within an hour the peritoneal junction is covered with plastic lymph, which the broken circulation throws out as an expression of the injury suffered. The healing process has begun. This plastic lymph should not be disturbed by manipulations, nor allowed

to be liquefied by bacteria from the mucosa. It will bury the stitches if they are pulled taut, from the peritoneal surface and no capillarity can take place the stitch (for eign body) being immediately on its way to the mucosa to slough out. This "rolling-in" process of sloughing of suture material is complete, for the most part in 5 days (Figs 2 and 6) which might be called the time of repair.

All recent bowel operations show that the importance of this coat is appreciated. This is especially true regarding the Rammstedt (23) operation for congenital pyloric stenosis, the operations upon small ducts—anastomosis of the ureter and anastomosis and transplan- tation of gall ducts—which were done in the experimental laboratory a long time before surgery adopted them and recently the aseptic operations for the resection of bowel by Collins (24) and Florine (25). Suturing over clamps is inconceivable without a knowl- edge of the integrity of the submucosa. As Halsted applied the method upon the heavy submucosa of the rectum and sigmoid areas in which it is impossible to use the Connell suture because of their inaccessibility there seems to be no reason why it should not be applied to the bowel high up.

#### CONCLUSIONS

1. In Lembert's time the principle was established that raw tissues of like nature will unite if held approximated long enough and union was secured by approximating the peritoneal coats.

2. Halsted showed that all intestinal sutur- ing must be with the submucosa as the basis (the skeleton).

3. Students should see this structure iso- lated; they take better stitches afterward.

4. The submucosa must be taken into con- sideration in regard to drainage of bacteria and toxins from obstructed loops of bowel and in regard to making and closing fistulae. It may be utilized to prevent extension of peritonitis by walling off areas.

5. All through-and-through and most Lem- bert stitches slough to the lumen of the bowel a few encyst at the serosa, being cut off by the action of the muscular coats.

6. The tendency to throw off a foreign

body by sloughing out is stronger than the tendency to absorb it.

7. Visceral union is a matter of sloughing of suture material and of absorbing superfluous tissue, and is accomplished in a few days.

8. From the study of this tissue there has been evolved the aseptic resection of bowel by Halsted and others.

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## ABDOMINOSCOPY

B. OTTO P. STEINER, M.D. ATLA T. GROSSA  
*From the Grady Hospital, Graduate School of Hygiene and Surgeons*

**ABDOMINOSCOPY** is a term which describes our new method of examining the organs of the abdominal cavity in reality an endoscopy of the abdominal cavity. As far as we know abdominoscopy has never before been performed on the living patient or on the cadaver. Also I have been unable to find any papers dealing with the experimental or theoretical phases of the subject. Therefore I believe that it is so far an unknown but practical method of examining the peritoneal cavity and that I am justified in calling it a new means of diagnosing abdominal diseases.

Not only the common practitioner but the specialized diagnostician as well would in many cases feel more assured if he could but look into the peritoneal cavity. Many methods, some of which are complicated of examining the abdominal organs have not proved successful and consequently after their use we are no wiser than before. It would be an ideal method of examination if we could look into the peritoneal cavity through a puncture and, without doing a laparotomy see the diseased organs clearly and sharply.

The first cases in which we attempted the method were acute cases in which paracentesis was indicated. An endoscope was put into the peritoneal cavity but we were able to obtain only practically negative results. We next decided to inflate the abdominal cavity of the cadaver with gas, and to study the conditions with the endoscope. Theoretically this seemed only partially feasible. Sometimes we were able to see clearly but on the whole the examination of the cadaver was not satisfactory because of postmortem changes.

We tried out experiments on bodies immediately after death and found that our assumption was correct. abdominoscopy was not only possible but yielded results far beyond our expectation. The whole problem was solved at once. A technique for practical use on the living body was perfected and our endeavors were far more successful than we

had obtained on the fresh cadaver as physical conditions for carrying out the abdominoscopy were more favorable.

## INSTRUMENTS

*a. Abdominoscope.* The instrument devised resembles the cystoscope. As the curved end of the cystoscope was found to be very useful it was made movable. The degree of curvature was regulated by a special mechanism at the opposite end of the instrument. To introduce the instrument with ease we were careful to regulate the curvature at the end so that it was in the arc of the endoscope.

While examining the cavity by extreme flexion the top of the curve could just be seen in the periphery of the endoscopic field so that we were able to use the top as a guide. The curve at the end of the instrument is of prime importance in keeping from the endoscopic field the different structures such as the liver edge etc. Thus, to a certain extent we can use the top as a *tracer*. Another important use of the end is as a palpator to determine the consistency and movability of the organs and the presence of gall stones. The magnification used in the telescope should correspond to that used in a cystoscope since a great magnification only makes the survey difficult and offers no advantage. The telescope should be exchangeable so that it can be introduced with the obturator and making it possible to remove it to clean it during an examination. The endoscope has a canal for the introduction of gas. This canal is similar to that used in a cystoscope for irrigation purposes. By means of this canal the gas is made to escape under control of the eye into any pockets. The air cock of the endoscope is connected to a bulb similar to that used on a blood-pressure apparatus. A 12 inch rubber tube which connects the air cock to the bulb is divided by a glass tube which contains sterile cotton for cleaning the gas. For examining the pelvis we recommend an endoscope with a direct outlook, but this is not necessary.

Examination can be made also with a cystoscope but the cystoscope does not give as satisfactory results. When the cystoscope is used the right hand cock for irrigation is connected with the connecting rubber tube and the left hand cock must be closed. The cystoscope must close airtight.

*b Trocar* The trocar must correspond in thickness with the abdominoscope. For the cannula for the trocar we use only *half a tube*. A larger trocar would make the introduction easier but would endanger the keeping of the belly airtight. In using a cystoscope it is best to take a tube of thin flexible metal, which is open in the whole length on one side. It will then be easy to bring the cystoscope through the slide-way into the abdominal cavity. When the trocar and cannula are removed together it is usually possible to introduce the cystoscope through the puncture canal but it is safer to use a tube as described especially if the patient is fat.

*c Gas for inflation* At first we used oxygen for better absorption. Now we are using the atmospheric air and have had no ill effects. When the examination is finished we slowly let out most of the gas so that there will remain only a small amount of the air in the belly. The use of the air cleansed by the filter mentioned has essentially simplified the whole procedure and has made possible the direct inflation with the bulb. It is essential also to sterilize the connecting rubber tube. At first we measured the quantity of air used but we have found that this is unnecessary for the abdomen is not very sensitive to inflation and easily withstands the quantity of air necessary for abdominoscopy.

#### TECHNIQUE

A purgative is given the day before examination and one quarter grain of morphine 20 minutes before puncture. The field of puncture is cleansed with benzine and then with alcohol and iodine. Local anesthesia with novocaine is used and it is a good plan to anesthetize also the adjacent peritoneum to prevent sensations during examination.

A stab incision is made through the skin and a puncture done with the trocar inserted. Puncture should always be made with the

abdominal muscles contracted. Usually there is a reflex contraction if none is present we let the patient sit upright. The puncture must be carried out steadily and cautiously. To prevent deep entrance into the abdominal cavity the trocar should be carefully steadied with the left hand while the abdominal wall is being penetrated. Carelessness in penetrating the abdominal wall must be avoided. The trocar is removed and the abdominoscope is introduced along the tube which remains in the puncture canal as has been described. Then we remove the tube from the puncture canal. This is necessary for an air tight closure.

The abdominal cavity must be inflated slowly. This can easily be done with the bulb. At first we were astonished to find how little resistance the abdominal wall offered to the inflation. More surprising was the little effect the inflation had on the patients. When the examination is finished, we must allow the air to escape slowly so as to prevent disagreeable sensations. We remove the endoscope and with the hand placed flat on the belly we press out what air remains. The wound is closed with one suture swabbed with iodine and a small dressing applied.

In most of the cases we made the whole examination using local anesthesia. Some patients are alarmed when the trocar is introduced but they complain of no pain even when a total abdominal examination is being made. We often keep them so interested in our description of their organs that they are quite amused.

#### ABDOMINOSCOPY

Of first importance in performing abdominoscopy is the original position and the correct changes of the position of the patient. As the air is of light specific gravity it stays uppermost in the abdominal cavity. Therefore through changes of position of the patient we are able to put the air in any place and thus displace the intestines at will. With the patient in a horizontal position, by moderate inflation we have a full view of all organs in their normal relation under the abdominal wall. For an examination of the upper part of the abdomen we elevate the

thorax above the horizontal. For an examination of the pelvis, we change the position of the patient so as to elevate the pelvis above horizontal. If we want to examine the organs in the left side of the abdomen we put the left side uppermost.

Therefore it is evident of how great importance is the position of the patient for the success of abdominoscopy. We need a safe and easily changeable table for the examination.

The abdominal cavity is inflated only moderately at first. If more air is needed during the examination or if the belly is not air tight, more air is easily gotten by compression of the bulb with the right hand. In this way at any time during the examination we are able to regulate the degree of inflation. Also it is possible under full view to bring air into pockets, under bowels etc.

The endoscope should be moved only under control of the eye.

*Internal palpation.* This palpation with the endoscope is very useful for determining the consistency and movability of organs and for sounding for gall stones. Internal palpation was found to be the most important item in the whole examination and it was the main consideration in the construction of the abdominoscope.

*Systematic examination.* The whole examination should be done with a fixed plan in mind, otherwise the wonderful natural pictures would tend to lead astray and thus prevent seeing important points.

In passing we might say that it is not advisable to look immediately for the suspected organ. At first we see a large endoscopic field which is increased in magnitude by moving the endoscope in different directions. After we have become familiar with the anatomical pictures of the region we then examine the diseased organs.

After a few examinations with the endoscope, the pictures become so clear and natural that they will be very easily understood.

*Site of puncture.* We try to make one puncture do for the examination of the whole peritoneal cavity. From a point slightly below and to the side of the umbilicus, it is

possible to see a good deal of the organs in the upper part of the abdomen, also we can rotate the endoscope so as to observe the region of the symphysis. Usually we know in advance the region where the pathology is located and choose a puncture point near by since this allows a better examination. Usually we avoid the mid line, and prefer the rectus muscle for the puncture, for the muscle has the advantage of a better closing of the puncture canal.

#### FIFTH AND RESULTS OF THE METHOD

When the puncture is made near the umbilicus, with patient in the horizontal position, we can look over the greater part of the abdominal cavity. The intestines and the omentum are usually found to be in one plane. The intestines show a hilly arrangement and peristalsis can be observed. We are able to see on either side to the lateral abdominal wall below to the symphysis, and above as high as the diaphragm. The nearness of approach to the different organs depends only on the length of the endoscope.

Puncture above the umbilicus gives a surprising survey over the upper part of the abdomen when the thorax is elevated. The liver is so far away from the abdominal wall that we can examine the surface to a great extent. On the observer's left we can see as high as the vault of the diaphragm. The top of the gall bladder if not visible can be demonstrated by turning the patient slightly to the right side so that the liver edge can be easily lifted by the abdominoscope. Usually a good examination of the gall bladder can be made. With the abdominoscope we can sound for gall stones if the gall bladder is not too tense.

With the same procedure a good deal of the upper and anterior part of the duodenum and of the pylorus can be demonstrated. Also there is a beautiful view of the uncovered part of the stomach. Palpating between the stomach and liver with the endoscope, other parts are brought into view. By inflating the stomach per os, the greater part of the anterior surface of the stomach can be examined. The normal spleen can usually be seen in the region of the hilus, sometimes

the convex surface is far removed from the diaphragmatic wall. We were often surprised to find the spleen far up on the lateral side.

Puncture in the lower part of the abdomen with the pelvis greatly elevated shows a beautiful endoscopic picture the first view of which was like the fulfillment of a dream: the whole pelvis lay free and unobstructed before the eye. The uterus, tubes, ovaries and sigmoid could have been shown very little better by laparotomy. Elevating the right side we were able to inspect the cecum, especially when puncture was made at Mc Burney's point. Not so rarely it is possible to see the appendix.

When we made it possible to survey under direct vision the abdominal cavity *in situ* the great importance of this method of examination in abdominal diseases became evident. We were not only able to see the organs far more clearly than we had expected, but through changing the position of the patient the endoscope revealed new and important regions. When examining the abdominal cavity for the first time with the endoscope a great surprise is in store for us for we see the different organs in their natural living colors.

The value of abdominoscopy lies in its ease of application and the marvelous results obtained through the direct, eye-controlled method of examination. In this paper we will not enter into the differential diagnostic possibilities through the abdominoscope we believe it will be possible to diagnose the questionable case correctly and without delay. We would call attention especially to the importance of its use in making an earlier and surer diagnosis thus making it possible to decide earlier as to the advisability of operation in cases showing grave pathology such as metastasis of the liver etc. The indication for its use in gynecological cases will need no further comment when the profession realizes the extent to which this ideal method of examination of the pelvic organs can be carried out.

The method used is not difficult. The technique may seem complicated but it is just as easy to carry out as is cystoscopy. The abdominoscope is easily introduced. The aseptic

preparation is scarcely more exacting than for puncture in ascites cases. The whole method is simplified by using cleansed atmospheric air which is forced directly by means of the bulb through the abdominoscope. In some cases examination can be carried out with a cystoscope but this is not so satisfactory. The examination can easily be made under local anesthesia without pain to the patient. Puncture with the trocar in place, if done carefully and the abdominal wall is contracted is without danger. Atmospheric air did not prove to be disadvantageous we did not have shock or any other complication in our application of the method. As a rule temperature and pulse remained the same. The patients were up and about the next day after examination. Pain at the site of puncture is unimportant. The general condition remains the same as before examination.

#### SUMMARY

The introduction of gas into the abdominal cavity has not only made endoscopy of the peritoneal cavity possible but has made vision very clear.

The abdominoscope is introduced through a puncture made with a trocar thus making it possible to view the peritoneal cavity in other words, abdominoscopy is similar to cystoscopy. The method is not difficult, is not dangerous and does not require a special amount of skill. The examination can easily be done under local anesthesia.

According to our practical experience abdominoscopy is a direct, ocular method of great practical use in the large field of abdominal diseases.

A questionable diagnosis can often be excluded or confirmed and a decision reached as to form, kind and extension of pathology. We would emphasize especially the importance of this method which makes it possible to make an early and sure diagnosis both in general surgical conditions and in gynecological conditions.

The very practical results of this relatively simple method of abdominoscopy will command for it a place similar to that now held by cystoscopy.

# EDITORIALS

## SURGERY GYNECOLOGY AND OBSTETRICS

FRANKLIN H. MARTIN, M.D.

ALLEN B. HAN, JR., M.D.

Managing Editor

Associate Editor

WILLIAM J. M. O., M.D.

Chief of Editorial Staff

FEBRUARY 1924

### THE TREATMENT OF ACUTE INTESTINAL OBSTRUCTION

DISCUSSING this subject some 15 years ago with a well known surgeon, he expressed the opinion that the treatment was by that time stereotyped and that there was nothing further to be said on the subject other than to persuade physicians and general practitioners to refer patients suffering from acute intestinal obstruction to the surgeon at an early stage of the illness. This statement would have been true and would still remain true provided that we saw these cases within 24 hours of the onset of the trouble.

For over 20 years I have been in the habit of describing cases of intestinal obstruction as I have met them in three different stages, the treatment of each of which must differ. The first stage is that in which the patient is seen early (within 24 hours). His general condition is good and there is but little intestinal distention. The second stage is that in which the patient is not seen until later—2 days, 3 days, 4 days. His general condition is good, but there is considerable intestinal distention and severe vomiting which may or may not

be stercoraceous. The third stage is that in which the general condition of the patient is bad. His pulse is feeble and perhaps intermittent, and vomiting is stercoraceous. The abdomen is greatly distended and the patient presents the appearance of one profoundly poisoned by the absorption of toxins whether the result of bacterial activity or a proteose intoxication or a combination of both conditions.

The treatment of the first stage consists in washing out the stomach with bicarbonate of sodium solution after which a general anesthetic is administered and the abdomen is freely opened. The cause of the obstruction is searched for and removed after which the abdomen is closed. The stomach is again washed out and the patient returned to bed. Lavage of the stomach after operation is more important in many cases, than it is before the operation.

In the second stage a similar procedure is adopted until the obstruction is discovered and removed. A separate incision should then be made through the left rectus muscle above the umbilicus, and a loop of the jejunum as close to its origin as possible is brought out through the wound. Into it is fastened a tube of 7 or 8 millimeter diameter after the method of Senn's gastrostomy except that only one or two purse string sutures are used so that too much subsequent narrowing of the intestinal lumen may be avoided. The intestine is then returned within the abdomen and fixed with two catgut sutures, one on each side of the tube to the parietal peritoneum and posterior sheath of the rectus. A limited piece is cut out of each side of the end

of the tube introduced into the intestinal opening so that if it should accidentally impinge upon the opposite wall of the bowel the intestinal contents could still escape freely.

By this procedure the distended intestines will be allowed to empty themselves of their poisonous contents. The central wound is then closed. The stomach is thoroughly irrigated as before and the patient put back into bed. An experienced nurse or a senior student is directed to continue irrigating the intestines with bicarbonate of sodium solution by siphonage through the tube. In this way without taxing the patient's strength and without producing any shock, the intestines are assisted to empty themselves.

This process can be continued for several hours, at the end of which time the entire intestinal area between the stoma into which the tube has been introduced and the point at which the obstruction existed will have been emptied of its contents and these contents replaced in large measure by a fluid containing sodium bicarbonate and glucose the absorption of which will counteract the tendency to acidosis and help to build up the reserve carbohydrate as well as replace the fluids of which the tissues have been deprived.

Impressed as I have been with the soundness and importance of the views enunciated by Mr Victor Bonney of the Middlesex Hospital London in the *British Medical Journal* I have discarded all other methods of emptying the distended intestines, and have followed the procedure outlined above.

The tube can be removed in 24 or 48 hours under gas or local anaesthesia and the opening into the intestine closed by a single mattress suture. Dr C. H. Mayo's suggestion of bringing the loop of intestine out through a hole in the great omentum may obviate the necessity of a suture for closure of the intestine after removal of the tube. Lac-

tose may also be administered in large quantities either by mouth or through the intestinal tube as it has been shown that lactose can eliminate proteolytic bacteria from the intestinal flora.

In the third stage the patient cannot stand the administration of any general anaesthetic and he is not even removed from the bed in which he lies. The stomach is washed out as before and a one half per cent solution of novocaine should be used to infiltrate the tissues in the middle line above the umbilicus through which an incision is made into the abdomen sufficiently large to introduce the finger and withdraw a loop of the jejunum as near to its origin as possible. A tube is then introduced into this fluid-containing segment of gut and siphonage continued as before described. Should the patient survive it may be possible to open the abdomen seek out the cause of obstruction and remove it at the end of a week. Meanwhile nourishment can be given through the tube directly the poisonous intestinal contents have been evacuated or it may be given by mouth and the tube need not be removed until the patient has recovered from the effects of the second operation.

I am convinced that in all cases of intestinal obstruction in which stercoraceous vomiting has occurred drainage of the jejunum as close as possible to its origin should be instituted. This drainage can be assisted by repeatedly filling up with bicarbonate of soda solution and siphoning off the intestinal contents after the patient has been returned to bed.

As has been pointed out by Dr J. E. Summers, of Omaha, Nebraska Bonney's method of performing a jejunostomy is the one flaw in his otherwise sound paper. The treatment of acute obstruction engrafted upon chronic is somewhat different. The site of the chronic obstruction will almost invari-

ably be found to be somewhere in the large intestine and in all such cases the bowel above the obstruction should be drained at once. A cecostomy after the method of Sir Harold Stiles gives the best results so far as killing the patient over his immediate dangers is concerned. This carries out Bonney's idea of draining the fluid containing segment.

Until physicians and general practitioners can be educated to recognize that there is no treatment for intestinal obstruction other than early surgical interference, the mortality attending the treatment of these cases must remain very much where it is today—a mortality that is a disgrace to the profession. I believe that the mortality attending the treatment of such a condition as acute intestinal obstruction should not be more than 1 or 2 per cent, but such a consummation can only be attained by operating upon these patients within 24 hours or 36 hours of the onset of the trouble.

It may be noted that I have not attempted to deal with one very common cause of intestinal obstruction as it is a different subject and requires different treatment, namely acute intussusception.

SIR WILLIAM TAYLOR

#### MEDICAL AND SURGICAL CO-OPERATION IN CASES OF DIABETES AND EXOPHTHALMIC GOITER

**I**N making diagnoses, the benefit to the patient from the close co-operation of internist and surgeon, is too well recognized and practiced to need emphasis. The importance of similar close co-operation in the immediate pre-operative preparation and postoperative treatment of patients with metabolic diseases is not so generally practiced on account of the customary separation of hospital staffs into medical and surgical di-

visions and these in turn into sub-groups, each with its own personnel, wards, and laboratory facilities. The result is often an unfortunate break in the continuity of medical co-operation in the first twenty four to forty eight hours after operation, and often even in the last twenty four hours before operation. In certain types of disease like diabetes and exophthalmic goiter this transfer of a patient from the medical to the surgical ward at the moment his life is to be endangered, and the corresponding change in the responsibility for his care to a group untrained in the refinements of the medical management of these diseases, may be a very dangerous procedure. To carry out surgical procedures on such patients successfully requires careful judgment as to the time, type or extent of operation, medication and diet. The best results are possible only when there is no interruption in the expert medical supervision and treatment before the patient goes on the operating table and likewise no loss of time in starting the appropriate postoperative care. The treatment of the medical emergencies that are bound to arise in these patients should be met with the same promptness as the surgical emergencies, and as these must first be cared for by the resident staff it is obviously advantageous that the internes who cared for the patient before operation should care for him afterward. The strictly medical complications, however, should be observed by the medical resident who has at his disposal the appropriate laboratory facilities as well as the training which allows him to carry out a program based on the principles laid down by the internist. The organization should be so regulated that the internist can easily keep in close touch with the progress of the patient during the operative period.

Divided or indefinite responsibility on the other hand, brings unsatisfactory results.

therefore the surgeon must assume the final responsibility. That he and his assistants should avail themselves of the benefits of the internist and the latter's assistants and laboratory facilities, is only a matter of common sense. The exact method will vary under different circumstances, but all methods will revolve around the essential point which, in brief, is maintaining unbroken the continuity of the pre-operative and postoperative treatment, and the prompt meeting of medical as well as surgical emergencies the former when promptly and correctly handled can often be prevented from becoming serious.

The surgical mortality rate in cases of exophthalmic goiter and of diabetes in which operation must be performed is reduced to a certain minimum by strictly surgical technique, skill and judgment, and a material reduction of this minimum should be possible by the co-operation of the internist and surgeon and their respective staffs.

That there has been a steady decrease in the mortality rate following surgery in cases of diabetes is shown by the statistics in Joulin's monograph. The following figures quoted in part illustrate the general results obtained. At the Massachusetts General Hospital preceding 1918 Fitz reported a mortality of 30 per cent between 1918 and 1921. Young found that it was reduced to 15 per cent. Strouse at the Michael Reese Hospital in Chicago in 1916 reported the mortality rate as 31 per cent, although there were no deaths among eight patients who were properly prepared. Krawek, at Berlin, in 1914 reported a mortality rate of 12 per cent after operations on aseptic tissue and of 22 per cent after operations on infected tissues. Berkman, at the Mayo Clinic in 1915 reported a mortality of 8 per cent in 26 operations, and in 1921 of 6.4 per cent in 233 operations, which at that time was a remarkable improvement. In Joulin's own

cases the rate, up to January 1917 was 18 per cent, and since April 1 1919 it has fallen to 9 per cent in 61 operations. A further step in advance has been made during the last two years by Wilder and Adams who report from the Mayo Clinic that as a result of an appropriate dietary control and the proper administration of insulin the mortality rate has been reduced in a series of 327 operations including those for gangrene on 251 diabetic patients to 1.2 per cent by operation, and 1.6 per cent by case. 141 of these operations were major surgical procedures, among which were 83 intraperitoneal operations with a mortality of 3.6 per cent. There were also 26 thyroidec-tomies, 5 nephrectomies and 7 thigh operations in cases of gangrene without a fatality.

Similarly the mortality rate in exophthalmic goiter has been reduced from the high figures that occurred in the past to 1 per cent by operation and 1.7 per cent by case, as recently reported by Pemberton. A great part of this reduction has been due to the discovery by Plummer that the peculiar and characteristic crises of this disease can be eliminated by the administration of iodine and that also this drug will prevent, in large part, the post-operative hyperthyroid resection which so often results in death. Those of us who have seen the benefits in diabetic surgery from the proper administration of insulin and appropriate dietary control are impressed with the similarity of the results obtained by the use of iodine and proper diet in cases of exophthalmic goiter.

As a result of co-operation between the surgeon and internist, the surgical mortality in exophthalmic goiter and in diabetes may be compared favorably with the death rate from similar major surgical operations on patients in whom the risk of operation is not increased by a serious and intrinsically dangerous metabolic disease.

WALTER M. BOOTHBY



# MASTER SURGEONS OF AMERICA

## MOSES GUNN

**D**R GUNN was born in East Bloomfield, Ontario County New York April 20, 1822 and was the youngest of four children. He died in Chicago November 4, 1887. His father Linus Gunn, a prosperous and well-to-do farmer and his mother Esther (Bronson) Gunn, were born in Massachusetts, of Scotch Laird ancestry. They were of strong character, efficient, and were Protestant Christians.

At an early age Dr. Gunn attended the schools of his neighborhood. At the age of 12 he was placed under a tutor, a theological student, who continued to teach him for three years. After that he entered the Bloomfield Academy which he attended until he became ill with pleurisy and empyema, which made him an invalid for several years. He told me the story of this early illness with elaborate details when he was quite sixty years old. After a long time, he said the pus "pointed" in the side, broke through a minute opening—surprised him one day by wetting his side—where it thereafter drained into dressings for many months. It finally healed but his side was sunken and his shoulder dropped. Although he lacked productive cough he was said at one time to have consumption and to be slowly approaching death. In spite of this he spent years with hard work and laborious exercises to straighten his body which he finally succeeded in doing, and when I first saw him at Ann Arbor in 1866 he was a perfect Apollo in appearance, and so continued until his final sickness.

He must have begun the study of medicine about 1842 and was doubtless moved to do so by his precarious health. He had a preceptor in Dr. Edson Carr of Canandaigua, New York.

In 1844 he entered the Medical Institution of Geneva, New York, and was graduated in 1846 after two courses of lectures of seven months each. During his second year he assisted the demonstrator of anatomy, Dr. Corydon L. Ford, acquiring a great fancy for practical anatomy.

He was prevented from going to college by his protracted sickness, but he was a universal student through life. He received two honorary degrees, the master of arts from Geneva College in 1856 and the doctor of laws from the Chicago University in 1877.

In 1864 the school became the "Geneva Medical College." It was closed finally in 1871. Later it became the Medical Department of the Syracuse University.



MOSES GUNN  
1822-1887



His enthusiasm for anatomy and surgery and his personal ambition and personal force were such that in a week after his graduation he started, in February 1846 for Ann Arbor Michigan, and at once began a private course of lectures on anatomy to two dozen students of the young state university and a few medical practitioners. He had brought with him from Geneva a huge cadaver. These were the first lectures of the sort in the State of Michigan.

He did some practice and continued private lectures on anatomy and surgery until 1849 when the nascent medical department of the university needed a professor of anatomy. He had already developed such a reputation for scholarship and teaching that over strong competition he won the place. In January 1850 the chair of surgery was founded and he was appointed to that likewise. In the winter of 1849 and 1850 before beginning his lectures on surgery he made inspection visits to the medical schools and hospitals of New York Boston and Philadelphia. His first class in surgery at Ann Arbor numbered 92 his last class (in 1866-1867) 525. In 1854 he resigned the chair of anatomy to Dr Ford of wide fame as a teacher of anatomy for a quarter of a century at Ann Arbor and elsewhere, but he continued in surgery until he went to Chicago in 1867.

He was married to Miss Jane Ferry in 1848. He moved his residence to Detroit in 1853 but journeyed to Ann Arbor twice a week thereafter during term time to lecture. In Detroit he engaged in general practice for a number of years, to confine himself to surgery later.

He was a regimental surgeon in the Army of the Potomac in 1861-1862 and was at the battle of Williamsburg. General McClellan was his hero in whom he could see no fault. His partizanship was shown in numerous letters to his wife, which she published in a worthy book of memoirs of Dr. Gunn after his death. His army service was severe on his health, and he returned a thin and debilitated man.

He went to Europe with doctor friends in 1879 better to recuperate from an attack of septicæmia from an arm infection. Accompanied by his wife he visited Europe again in 1881 for a pleasure trip.

In 1867 he resigned from the University of Michigan and accepted the professorship of surgery in Rush Medical College where he remained until his death. He gave here twenty years of brilliant service in didactic and clinical surgery. He was a teacher born—his lectures were brilliant and would have made good literature if printed exactly as uttered.

He was a man of striking personality and character. Tall erect, straight and well proportioned graceful in movement, fastidious in taste and action—and in clothes—it was all accentuated by his Burnside beard and long hair made into ample ringlets each morning by the insistent fingers of his devoted wife. He frequently rode horseback to his lectures and was a striking figure mounted on the handsomest horse procurable. He never boasted and was not vain although

some who did not know him guessed that he was. He was a consistent church man (Episcopalian), a cheerful Christian, and something of an optimist.

He had many of the best traits. He was meticulously truthful and exact in his words and absolutely clean in speech. He was fair to others, true to his character and profession, and too full of the business of life to indulge in jealousy or the disparagement of others.

He was a man of great industry and study. He was a fine general scholar—a speaking German scholar and a fair French one. He had much joy in amateur astronomy and had a telescope mounted in his house. One of his cardinal virtues was that of punctuality in all appointments. No doctor ever charged him with tardiness at a consultation.

He was an elegant operator and in every way a superb surgeon. He studied his cases and his work was singularly free from unexpected incidents, and he had no ornamental gestures or unnecessary talk or actions at his operations. To him the body of his patient was sacred and an operation was a serious business.

His one or two prolonged clinics each week at the College meant a great surgical service. He operated regularly at the Cook County Hospital and the Presbyterian Hospital and occasionally at other hospitals in Chicago.

For a man of his age in the profession when aseptic surgery came into vogue, he adjusted himself to it with surprising facility and faith—and great satisfaction.

On occasion at Detroit he was an editor of medical journals. His writings and occasional addresses were scholarly utterances without verbiage or excessive statements. His lectures were all exercises in general culture.

His teachings always ennobled medicine and surgery. They were never allowed to lag in dignity or intense interest to his classes. He made many minor and one great contribution to the science of surgery. This was his work on dislocations of the hip and shoulder joints. The reduction of these dislocations had always been to surgeons a melancholy source of great labor, failures, and awful sometimes brutal treatments by great force. By laborious and painstaking work in dissections and manipulations, he showed that by putting the bone in the exact position that it had at the moment of dislocation and then exercising moderate reverse force the bone passed into normal position easily without great strain or suffering. This doctrine is so logical and self-evident and has proved so true and satisfactory in actual practice that it has stood substantially without challenge. He announced his theory before the Detroit Medical Society in 1853, thus early in his career. He reaffirmed it in 1859 with amplifications and he restated it with ampler illustrations in 1884, only three years before his death.

NORMAN BRIDGE

# TRANSACTIONS OF SOCIETIES

## CHICAGO SURGICAL SOCIETY

REGULAR MEETING HELD APRIL 6 1923 DR. FREDERICK G. DYAS PRESIDING

### ADHESIONS ABOUT THE ASCENDING COLON SIMULATING CHRONIC APPENDICITIS

DR. CHARLES DAVISON read a paper on "Adhesions about the Ascending Colon Simulating Chronic Appendicitis" (See page 171)

#### DISCUSSION

DR. DON J. ROTHER (by invitation) The excellent paper just presented has covered the subject very thoroughly and little remains to be said aside from the roentgenologic aspects. These cases mentioned were diagnosed during careful, routine examinations of the gastro-intestinal tract. In addition to the 10 cases cited, at least 5 or 6 others have been found, two of which were verified at operation. Dr. E. A. Meyer saw one of these latter in which the adhesions extending from the parietal peritoneum upward and inward across the ascending colon, the transverse colon, were very dense and fibrous, and almost the thickness of a man's hand. Roentgenoscopy and roentgenography are both essential in establishing a positive diagnosis. There is a marked difference in the roentgen findings of these adhesions, and of those of inflammatory origin. A few cases presented evidence of both conditions. It requires no special skill or equipment to diagnose this condition by means of the roentgen ray but a careful, complete examination of the entire gastro-intestinal tract is of the utmost importance.

DR. WILLIAM M. HARRIS In using an enema or barium meal in the diagnosis, which do you consider the more important?

DR. DAVISON The barium meal is the more important. In many of them we use both.

DR. JOHN R. HARGER Recently two cases have come under my observation—both of which presented a condition from an X-ray standpoint, similar to what Dr. Davison has just presented. In the one case the first part of the transverse colon ran parallel to and just to the medial side of the ascending colon for a distance almost the length of the ascending colon. This patient has had several attacks resembling a low grade appendicitis but has not yet submitted to operation even though a diagnosis of some form of adhesions has been made.

In the other case the first part of the transverse colon ran parallel to the ascending colon and immediately in front of it, then extending just to the

right of the cecum and on into the pelvis. In this case the attacks of pain were referred to the region of the hepatic flexure and upper part of the ascending colon. At operation no adhesions were found but the entire ascending colon and especially the hepatic flexure was found to have a mesentery from 4 to 6 inches long, permitting a very free movement and no doubt at times a kinking of the hepatic flexure. In both cases there was a distinct filling defect at the flexure.

DR. R. W. MCNEALE I would like to ask Dr. Davison if he considers these membranes or adhesions any way different from the membranes described by Jackson. The old Jackson membrane picture was considered a congenital affair and he states that one half of these cases have been operated on while others have not been operated on, although showing practically the same pathology. Whether they are considered adhesions at the primary operation, or whether they are all congenital adhesions is a question, and if the latter do they differ from the membranes described by Jackson? Are they the same thing, or is this a report of the finding of Jackson's membrane? It looks as though it extends from the parietal peritoneum over the ascending colon and attaches itself to parts of the transverse colon.

DR. DAVISON (closing) These patients complain of errors of digestion continuing for some time after the ingestion of food, suggesting duodenal ulcer. They constantly complain of moving gas in the intestines. The cases reported were X-rayed, in different positions, from the esophagus down to the rectum to exclude other lesions. In each case the diagnosis was definitely established by X-ray and the diagnosis confirmed at operation.

This lesion is entirely different from the membrane described by Jackson. Jackson's veil extends over the lower part of the ascending colon. It is so thin that the blood vessels of the colon can be seen through it as it slides back and forth over the intestine. When the intestine is freed from Jackson's membrane the colon assumes its proper size, shape, and position at once and the peritoneum of the colon beneath this membrane is not abraded.

In the adhesions which we have described these conditions are different. There is actual attachment between the colon and the adhesion and when they are separated at the line of cleavage, leaving a raw

surface, a peritoneal layer is not apparent. The adhesion is, in all probability, due to a long continued, low grade infection from the colon, with deposition of new tissue. As the tissue organizes and contracts

it decreases the area of the colon at that point and rotates the colon in the direction of the fixed attachment of the adhesion. In this manner the stenosis of the colon is progressive.

## REGULAR MEETING HELD MAY 4, 1923 DR. FREDERICK G. DYAR, PRESIDENT

### THE ISOLATION OF THE SUBMUCOSA

DR. A. J. GRAHAM read paper on The Isolation of the Submucosa as an Aid in Intestinal Anastomosis. (See page 359)

### DISCUSSION

DR. A. J. OCTAVIER: This scholarly paper of Dr. Graham's deserves careful consideration because it represents an enormous amount of careful work, and it is the first paper since the one written by Dr. Husted which emphasizes the importance of the submucous connective tissue layer of the alimentary tube as regards its importance in intestinal surgery.

Since the remarkable work by Lembert, over one hundred years ago published, I think, in 1819, which described the first real successful method of intestinal suture, every successful method which has been described as successful because it utilized the submucous connective tissue layer and the success depended entirely upon the proper use of this tissue. But sufficient stress has not been laid upon this fact, and for this reason Dr. Graham's paper should be thoroughly appreciated.

DR. ALFRED A. STRAUSS: I think that Dr. Graham has called the attention of the profession to a very important and very vital point in gastrointestinal surgery, namely the importance that the submucosa plays in forming a union that is safe from leakage.

I think the practical point of application of this interesting work that Dr. Graham has done is that when the mucosa and submucosa are sutured as one layer the muscular layer and peritoneum as another layer the inner suture which is composed of mucosa and submucosa, constitutes the vital parts

of the strength of the bowel. There is also an exudate and serum poured out between the inner layer and outer layer of sutures which acts as a double safeguard against leakage. Sutured these layers distinctly does not cut off the important blood supply that is present between the submucosa and muscularis, while in those types of sutures where the suture dips down through all the layers to the submucosa, there is bound to be strangulation of the blood supply and more of an anastomotic decrease which cuts through and is more apt to produce leakage.

I have demonstrated from animal experiments that the best suture for getting perfect approximation and a good union without any scar formation is a simple over and over suture, the inner one catching the mucosa and submucosa slightly on the slant so as to catch a large surface of the submucosa and practically holds the mucosa edge to edge. The importance of this stitch is that it is the strongest layer of all the coats. The seromuscular suture can also be sutured edge to edge just as you close the skin by an over and over suture, in the type of a Lembert suture, which simply inverts the muscularis very slightly.

DR. GRAHAM (closing): In a resection (amputation) of a portion of bowel, the major injury to the organism, and the one to which expression is given immediately is that to the circulation. The blood is thrown against the closed ends of the arteries, the serum exudes and clots, forming the plastic exudate. Lembert took advantage of this immediate exudate in approximating the peritoneal coats to which it could adhere. With the sealing power of this exudate any stitch, securing the submucosa and firm approximation of the peritoneum, will obtain a tight joint.





# Felotbuch der wundtartzney.



Die Besichtigung des Buches ist zu Straßburg durch Johann Schott

# THE SURGEON'S LIBRARY

## OLD MASTERPIECES IN SURGERY

By ALFRED J. BROWN M.D. F.A.C.S. OMAHA

### THE FIELD BOOK OF THE TREATMENT OF WOUNDS

THE latter part of the fifteenth and beginning of the sixteenth centuries saw much more attention paid to the care and treatment of wounds and surgeons whose province it was to care for the wounded, were attached to the armies in the field. Jerome of Brunswick had written his surgery in 1497 and thus opened the way for amplification of methods. In 1517 Hans von Gersdorff called Schylhans who describes himself as a citizen and wound treator of Strassburg, published his *Feldbuch der Wundartney* which was printed in Strassburg by Joann Schott. It is illustrated by many woodcuts attributed to Hans Pilgrim known as Waechtehn. Some of these are original while others seem to be more careful drawings and better prints of the illustrations of Jerome's surgery.

The *Feldbuch* contains the first known illustration of an amputation. The patient is seated in a chair. The leg which is being amputated is held by an assistant. A cord is wound tightly around the leg above and another below the site of amputation but the blood is shown pouring in streams from two holes in the proximal stump. A patient whose left hand is bandaged stands calmly watching the procedure while the surgeon wields the saw. The legends to the illustrations are all in poetry and many of them are extremely complimentary to Gersdorff who apparently has no intention of hiding his light under a bushel. The legend over the amputation illustration reads:

Arm beln abschneiden hat sein kunst  
Vertriben sanct Antonien brunst  
Gebort auch nit ein yeden su  
Er schuck auch dan wie ich im th

T cure Saint Anthony's fiery smart  
Removing arms has certain art  
Which is not in all men, tis true  
So send your case to me to do

To be sure Gersdorff has a good excuse for this self esteem, for he states he had performed between one and two hundred amputations, probably many more than any other surgeon up to that time. He says that he has heard that giving patients drinks to make them sleep makes them delirious. So in his amputations, he has never given drinks, but describes method of using opium, gradually given, which causes sleep. He then wakes his patient by the in-

halation of vinegar. He does not ligate vessels in the stump but uses the cautery or caustic plaster to check the bleeding. The stump is enclosed in the bladder of a bull, ox, or hog.

Another interesting illustration is that of the wounded man, later evolutionary type of the old anatomical diagrams, which shows different wounds and the various implements which cause them. These wounds are placed at the proper positions for blood letting or ligation of vessels. The legend over the illustration reads:

Wiewo ich bin voll Streich un(d) Stich  
Zermoracht verwundet lamerlich  
Doch hoff ich Gott kunstlich Artney  
Schylhans der werd mir helfen frey

When I am stricken hip and thigh  
Or wounded grievously do lie  
I hope that God will bring to me  
Schylhans artistic surgery

Gersdorff places great stress on anatomy. This portion of the book is illustrated by a plate of the opened torso attributed to Wendelin Hock and probably engraved by Waechtehn called Pilgrim and skeleton which is commonly known as the Waechtehn skeleton. In the surgical portion of the work he emphasizes constantly the fact that the surgeon does his work with his hands. The very definition of the word shows this as he says. The name Chirurgicalis springs from *cheir* in the Greek tongue which means a hand and *ger* meaning hence a surgeon is a hand worker or wound physician.

Among other things Schylhans made and illustrated a trivale speculum for use in the vulva and anus which is an improvement over the bivalve speculum illustrated by Jerome of Brunswick.

In addition to the classification of wounds and fractures and their treatment he classifies the various medicaments used according to their action and defines such action as styptic, sedatives, etc. He adds a materia medica and the proper dosage.

Gersdorff takes up other common diseases in addition to wounds. He discusses fistula and carbuncle. The pestilence he calls anthrax. Cancer and leprosy he considers incurable but gives methods of treatment which he calls palliative. Ergotum he describes as *ignis sacer* or St. Anthony's fire and pictures a sufferer from it holding up a gangrenous hand which has burst into flame to St. Anthony and appealing to him for relief. For the cure of severe cases Gersdorff advises amputation.

## REVIEWS OF NEW BOOKS IN SURGERY

I suppose that the average individual, either medical or lay would be inclined to doubt seriously whether there is such a thing as romance in the bacterial world, that is if he ever gave the matter a thought. Yet in this book a cold blooded scientist, one who is thoroughly familiar with the ways and doings of the microscopic world of bacteria, brings out the romance in that world so that it reads like a best seller. It is not a textbook, yet it was written to instruct and to make the instruction palatable. And in that it has succeeded neither is it a kindergarten book, written in words of one syllable. There is merit in that. All test the digestion of the wisest medical man.

It can be recommended as an antidote for much of the present day mikrobiphobia, and for that alone it is a good book for the physician to place in the hands of his patients. Furthermore the physician himself can find food for thought in the chapter on Immunity Susceptibility and Resistance to Infection. In this there is a distinctly new angle.

The book has another merit. It is a synthesis, that is the author brings knowledge from many different angles to bear on the subject, and out of this he builds up the broad general principles that underlie the world of bacteria. It is an unusual book.

B H MOORE

ONE knows the appearance of a new edition of this most excellent book. Of especial interest is the publication in one volume instead of two as was the case with the first edition. None of the colored plates of the latter have been omitted and much new material both in the way of text and illustrations added. The chapter on optical principles and the interpretation of images has been rewritten so as to make it less technical.

It is not easy for those accustomed to working with cystoscopes giving images which have been corrected by lenses so as to be seen inverted to

become accustomed to many of the colored plates in this book, and it is to be hoped that for American readers at least the inverted images will be omitted in future. The authors suggest the use of an apparatus to accomplish this but inasmuch as we German English, and our own books on cystoscopy, have made these changes we fail to see the necessity of making these corrections from inverted to non-inverted views by the employment of a special apparatus.

Another suggestion for future editions is that an English or American urologist should be called upon to write the English legends. The use of the term swelling for ureteral papilla or such legend as swelling of bladder by retroverse uterus or the employment of bladder ground for floor or forside for anterior wall are only a few of many regrettable errors, especially in view of the fact that the German and Italian legends are uniformly correctly translated.

The outstanding features of the book are its colored plates, and even if one could not read a word of the text, a glance from time to time at this most remarkable collection of cystoscopic views would repay the purchase.

The prelude of the chapter on posterior urethroscopy reveals the fact that French urologists have adopted the McCarthy instrument in preference to any European one. The chapter on pyelography has been greatly enlarged in this edition but considering the vast material at the disposal of the authors many more diseases should be included than is the case. One misses reference to our methods of gradual dilatation of the ureter by employing number of bougies, in the section on non-operative delivery of ureteral calculi. The subject of the use of the high frequency current is very thoroughly covered.

The book is more than a simple treatise on cystoscopy and ureteral catheterization, and really includes many subjects which are not ordinarily taken up in our monographs, hence its appearance in an English edition is very desirable.

DAVID N. ENGLISH

COLLECTIONS AND THE MICROSCOPE. By Arthur I. Knodell. New York: Hoeber-McMillan Co. 1923.  
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## BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

AKUTERES BAKTERIELLES ERGEBNIS. Bearbeitet von C. Fraas, Berlin. Th. Fischer, München. R. Howe, Graz. K. Hofme, Graz. H. Hofmeier, Elberfeld. O. Mayer, Wien. B. Mayrhofer, Innsbruck. G. von Noe, Innsbruck. H. Späth, Wien. M. Stolz, Graz. R. von den Velken, Berlin. Herausgegeben von Professor Dr. G. Fraas. ed. Berlin. Bear-

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**PEDIATRICS.** By Various Authors. Edited by Isaac A. Abt, M.D. vols I and II. Philadelphia and London W. B. Saunders Company. 923

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**GYNECOLOGY.** By William P. Gray, A.B. M.D. F.A.C.S. 3d ed. revised. Philadelphia and London W. B. Saunders Company. 923

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**LES ULCÈRES DE L'ESTOMAC ET DU DODÉCÉNUM.** By Ed. Esnauze et Gaston Darnaud. Paris Masson et Cie, 924

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**ESSENTIALS OF ORAL SURGERY.** By Valdy Payson Blair, A.M., M.D., F.A.C.S. and Robert Henry Ivy, M.D., D.D.S. F.A.C.S. St. Louis C.V. Mosby Company. 1923

**THE STOMACHICUS CERVICO-THORACICUS.** By Prof. Thomas Jomarde. Paris Masson et Cie, 923

**THE NEW DICTIONARY GUIDE TO SCIENTIFIC PEDIATRY IN HEALTH AND DISEASE.** rev. ed. By John Harvey Kellogg, M.D., LL.D. F.A.C.S. Battle Creek, Michigan. The Modern Medicine Publishing Company. 923

**CLEFT LIP AND PALATE.** By Truman W. Brophy, M.D. F.A.C.S. Philadelphia P. Blakiston & Son & Co. 923

**DIAGNOSIS AND TREATMENT. ACUTE ABDOMINAL DISEASES, INCLUDING ABDOMINAL INJURIES, AND THE COMPLICATIONS OF EXTERNAL HERNIA.** ed. By Joseph E. Adams, M.B. M.S. (Lond.) F.R.C.S. (Eng.) New York. Williams Wood & Co. 923

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**HANDBOOK OF SURGERY.** By George L. Chaes, M.B. C.M. F.R.C.S. (Edin.) New York. Williams Wood & Company. 923

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**HANDBOOK OF AMERICANISTS.** 3d ed. By J. Stuart Ross, M.D. Ch.B. F.R.C.S. E. New York. Williams Wood & Company. 923. Edinburgh E. & S. Livingstone. A MANUAL OF SURGICAL HANDICRAFT. A PNEUMOTHERAPY. ed. By J. Rendrew White, M.D. (N.Z.) F.R.C.S. (Edin.) Dunedin, New Zealand. Cooke Somerville Wilkie Ltd. 923

**A COMPANION TEXT BOOK OF ORBITAL AND EYE COLLECT.** By J. M. Moore, M.D. F.R.F.P. and S. (Glas.) James Hargreaves, M.D. F.R.C.S. (Ed.) James Young, D.S.O. M.D. F.R.C.S. (Edin.) and James Hendry, M.A. B.Sc. M.D. Edinburgh, Scotland. I. & S. Livingstone, 923. American Distributors, New York. Williams Wood & Company. 923

**X-RAYS. THEIR ORIGIN, DOSE, AND PRACTICAL APPLICATION.** By W. E. Shaw, B.Sc. (Lond.) First P. Bristol. John Wright & Sons, Ltd. 923

**CHIRURGIA.** By Dr. Luis C. Magallon. Buenos Aires. Imprenta San Martin, 923

**COLLECTED PAPERS FROM THE SECOND SURGICAL DIVISION OF THE NEW YORK HOSPITAL, 8 West 6th St.**

**REPORT OF THE SURGEON GENERAL UNITED STATES ARMY TO THE SECRETARY OF WAR.** Washington. Government Printing Office. 923

**INTERNATIONAL QUESTIONNAIRE.** Journal of the National Institute of Social Sciences. of viii

# AMERICAN COLLEGE OF SURGEONS

## THE LAYING OF THE CORNER STONE OF THE JOHN B MURPHY MEMORIAL BUILDING

THE great desire expressed by the representatives of all classes of Chicago citizens to provide a fitting memorial to John B. Murphy the man whose scientific achievements have made his name familiar throughout the world, and the results of whose work were so vital in their importance and so original in character that they are more and more appreciated as time passes, led to the formation of a definite plan and an organization for the purpose of making possible its realization.

The form of memorial, fittingly chosen by those in charge, was living in character that is, a great organization devoted to the scientific pursuits to which Murphy gave his life and of which he was one of the founders and a leading and most devoted member. Its tangible form being a great building especially designed to meet the requirements of the American College of Surgeons.

The work of securing the required funds occupied two years and at times seemed to be impossible of success, in the main, because men of means had become weary from the many requests upon them for financial assistance in behalf of innumerable projects. The hope was realized through the active and self-sacrificing co-operation of Doctor Murphy's family, friends and admirers, together with the organized effort of a large number of members of the medical profession from the Atlantic to the Pacific Ocean, who were appreciative of his achievements and who also knew that the memorial building will be of direct great value to the work of the organization which was chosen as the recipient.

On October 23, 1923, a very notable event occurred in the history of Chicago in that on that day was the laying of the corner stone of the John B. Murphy Memorial Building with appropriate ceremony. A great throng was present composed of representatives of all classes, and the exercises, although very brief were most impressive in character. Among those who took part were Mr. Leroy A. Goddard, president of the Memorial Association, who presided in place of the Honorable William A. Dever who was unexpectedly called from the city. Dr. William J. Mayo, the

daughters of Dr. Murphy and other distinguished guests resident in the city, leading members of the medical profession, a great number of the Fellows of the College, and the Board of Regents who gave a touch of color due to their caps and gowns of crimson and royal purple. The real significance of this occasion, which undoubtedly was apparent to all, was due to the fact that the beautiful building to be erected will serve as a memorial to the man who was such an honor to his city and country on account of the value of his life's work and also because the memorial will necessarily be looked upon, as it is, as one of the few great evidences of the world's appreciation of the services which have been rendered by the medical profession to suffering humanity.

### ADDRESS OF WILLIAM J. MAYO

DR. WILLIAM J. MAYO. The American College of Surgeons was organized in response to a great human need. Modern surgery had developed with such extraordinary rapidity that it had outgrown the existing methods of medical education. Surgery in the pre antiseptic day was confined largely to necessary life-saving operations in emergency cases. The medical man who first saw the patient had to care for him, and this, of course, is still true in certain acute conditions. In a vital emergency such as hemorrhage or acute obstruction of the bowels, it is most important that operation be quickly performed. Early operation, even by one who operates only occasionally, gives better results than those achieved in the later stages by the greatest surgeon in the world. As surgical science advanced however many medical men with the best intentions attempted operations which were not imperative and for which they had not the training, knowledge or skill. It may be said in extenuation that surgical training was not easy to obtain at this earlier period; the large majority of operators learned by experience, profiting by their mistakes. There was no other way. Today there are ample opportunities for surgical training, yet of 150,000 medical practitioners in the United States, more than 50,000 are performing operations, only about 10,000 of whom are well qualified surgeons.

There is a sufficient number of trained surgeons in America to do the necessary work, and the untrained men, in justice to the patient, should not undertake surgery.

The founding of the American College of Surgeons was primarily in the interest of the patient. Its purpose was to band together the competent men in general surgery and the men in highly developed surgical specialties, of which ophthalmology for instance, had already attained a distinctive position, recognized both by the medical profession and the laity. An organization of this magnitude was a colossal undertaking but the vision and extraordinary organizing ability of Franklin H. Martin made possible the founding of the American College of Surgeons ten years ago. Today the directory of the College contains the names and addresses of more than five thousand responsible surgeons in North America and gives at a glance information with regard to reputable men in all parts of the country competent to perform necessary operations.

In the development of the Fellowship not only the surgical ability but also the moral character of the candidates was taken into consideration. The man of ability without character who trades commercially on the confidence of the patient is the most dangerous member of the profession.

The American College of Surgeons is not an autocracy controlled by a few men. Before a man can be examined by its officers his qualifications and character must be approved by the central committee of his state. The younger surgeon who applies for fellowship serves what might be called a probation period of from six to eight years after graduating in medicine. Not only must he be trained, but he must show that he is capable of applying the art of surgery in the best interest of the patient. Here in the American College of Surgeons differs from those organizations abroad on which it was modeled, in which knowledge of surgical science alone is required.

Among the many functions of the association is that of aiding the surgeon to make scientific progress. *SURGICAL GYNECOLOGY AND OBSTETRICS*, the official organ of the College, is, I believe, the greatest surgical journal in the world, and a powerful influence in the education of the surgical profession. The policies of the journal are controlled by the Board of Regents of the College. Clinical surgical meetings of an educational character are held in various parts of the country each year which are of great value, and act to keep the Fellows in touch with the latest and best in surgical science.

One of the most important accomplishments of the American College of Surgeons is the standardization of hospitals, recently completed for nearly all the one-hundred-bed hospitals of the country. When this work was undertaken most of the hospitals, except a few in the great centers, had only the most meager records, and were without pathological data. They were, in fact, little more than boarding houses where any physician might take a patient, and with the assistance of those in the hospital, perform operations. The hospital, in a way gave unfounded confidence to the patient that the operation would be done properly. It sounded well to say that the hospital had an open staff, but in practice it was extremely bad for the patient. Today nearly all hospitals have adequate records and pathological data, and the staffs are limited to those men who have a right to do surgical work. No achievement of the College has been of more far reaching importance to humanity than this.

The organization has been greatly interested also in the education of the nurse, who has become an adept in many technical specialties. Positions as technicians of various sorts are now held by highly trained nurses, which gives the physician an opportunity to do other work. When one considers that the nurse completes her professional training in three years, and is self supporting at the same time, and that the physician spends from seven to eight years of time after graduation from high school, and about eight thousand dollars in money for his training, the economic value of the higher grade of trained nurse is plainly evident.

The American College of Surgeons is truly American. As might be expected, it enrolls Canadians, people of our own race and tongue, who are joined to us by indissoluble bonds of sympathy. The organization has recently formed an alliance with the surgeons of Mexico and Central and South America, this alliance has developed a union of scientific interests which will do much to promote international peace and harmony. The intellectual intuition and tact and the beautiful dexterity of the Latin peoples have made their surgeons among the greatest in the world. Our desire for a better understanding and a closer scientific relationship with the Latin Americans is fully and cordially reciprocated by these surgeons. Exchange of visits by the surgeons of North and South America is most inspiring, and productive of lasting good.

The American College of Surgeons is looking to the future. In 1914 it was voted to raise, among the Fellows, an endowment of \$1,000,000, the

income of which was to be used for scientific purposes. More than \$600,000 of the amount has been secured. In 1920 public-spirited lay citizens of Chicago and a group of the Fellows residing in the city presented to the College the beautiful home where many important activities are carried on. To the east of it and on the same plot of ground are located the headquarters of the official organ of the College, *SURGERY GYNECOLOGY AND OBSTETRICS*, and by the generous provision of the owner Dr. Martin, this eventually becomes the property of the American College of Surgeons.

We meet here today in the center of this ground to lay the corner stone of a building which has for its purpose the attainment of the highest ideal of the human race, aiding the sick and the suffering. It stands on a favored spot in the heart of the City of Chicago, which lies so near the geographical center of North America. Its magnificent proportions make possible a library, a museum and meeting rooms for the various purposes of the Fellows of the College and in time it will become one of the greatest heritages of the surgical profession of America. We dedicate this fitting monument to the greatest surgeon of his day John B. Murphy one of the founders of the College who gave unparagonably of his strength and talents to aid in the establishment of the organization, and whose noble spirit will always sanctify this ground.

**DR. FRANKLIN H. MARTIN.** It may be of interest to enumerate here the particular reasons why the American College of Surgeons should seek to build a memorial to Doctor John B. Murphy. May I remark on these reasons as we review the items in this sacred box, which is to be placed in the corner stone.

First, a copy of the first issue of *SURGERY GYNECOLOGY AND OBSTETRICS*, of which Doctor Murphy was one of the founders and the first chief of the Editorial Staff and which is now the official journal of the American College of Surgeons.

Second, a copy of the same journal which issued the call (backed enthusiastically by Doctor Murphy) for the first meeting of the Clinical Congress of Surgeons of North America, the organization which was the forerunner of the American College of Surgeons.

Third, the resolution calling for the organization of the American College of Surgeons, in-

troduced at the New York meeting of the Clinical Congress of Surgeons of North America in 1911 seconded by Doctor Murphy and supported by him in an impassioned speech.

Fourth, a copy of a photograph of the first Board of Regents of the American College of Surgeons, of which Doctor Murphy was one of the most influential members.

Fifth, a copy of the first directory of the American College of Surgeons (1913) and a copy of the directory of today (1923).

Sixth, in addition to these reminders of Doctor Murphy's personal interest in the American College of Surgeons, we are placing in this box articles of particular interest to Doctor Murphy's friends and dear ones, all of which will be a reminder to those who come upon its contents in the future of this day, October 23, 1923, when his daughters, with loving hands, laid them away. Among these articles are family mementos, copies of the Chicago daily papers of this day and a copy of the remarks on this occasion by Dr. William J. Mayo.

However, Mr. President, this but represents our warm friendship for a great man. The need that is placed here by twenty-five hundred of the confreres of Doctor Murphy was matured from his great work as a teacher as a citizen, and as a surgeon. By all of this not one iota will be added to his great fame. When in the future generations the contents of this box are revealed, those who survey them will have been conversant with the fame of our great surgeon, but this will serve to emphasize that we who lived with him—his contemporaries, his friends—appreciated him and sought to demonstrate our love by erecting to his memory this monument.

**DR. A. J. OCHSNER.** I have the honor of laying this corner stone in memory of a charming friend, a noble citizen, and an enthusiastic organizer of the American College of Surgeons, a constant worker for the development of the College of Surgery, the greatest surgical teacher that this city has ever produced, whose words and works will live in the actions and thoughts and words of thousands of his disciples and their disciples.

The corner stone was raised from the blocks and Dr. Ochsen took the trowel, dipped it in the mortar and spread the mortar over the foundation. He was followed by Mrs. Benedict, Mrs. E. N. Hurley, J. Mrs. J. T. Murdock, and finally by Dr. Martin.

## FELLOWSHIP IN THE AMERICAN COLLEGE OF SURGEONS

BY ALBERT J. OCHSNER, M.D. F.A.C.S. CHICAGO

IT is important that we have a clear idea of what it means to be a Fellow of the American College of Surgeons. It means primarily that the surgeon who has attained this honorable position has been judged and found qualified in all important respects by those who know him most intimately.

The judgment is passed by a credentials committee selected by ballot by the Fellows of the College for each individual state and by a central committee acting for the two continents of North and South America, who weigh carefully all of the facts brought before them through inquiries directed to fellows whose work brings them in contact with the applicant.

## QUALIFICATIONS

**Honesty.** The first and most important qualification is honesty. If the American College of Surgeons cannot conscientiously vouch for the honesty of a surgeon it has no right to include him in its Fellowship because it would not be just to the public. A dishonest surgeon, no matter how skillful, is a menace to the community.

**Ability.** The second qualification is ability. A man without ability should not be vouched for to the public which has no means of determining whether the surgeon possesses the ability to diagnose the disease or the necessary skill to perform the serious work which he may have to undertake. An honest man with less ability is far safer than a dishonest man with greater ability. But the College must demand both honesty and ability.

**Education.** There was a time when educational facilities were so meager in this country that many most excellent surgeons were produced through almost superhuman effort although greatly handicapped through lack of educational opportunities, but in every case these men made use of all the available opportunities. Consequently the College of Surgeons has a right to demand that the present generation make use of the improved conditions which are now available. It is proper that, at least for all of the younger applicants, a very high degree of educational qualification be demanded.

**Experience.** The older surgeons can remember when only few opportunities for gaining experience were available before entering individual practice. The hospital positions for young men

were few, there were no fellowships and very few assistantships, consequently the young surgeon was compelled to accumulate his experience in his personal practice.

At the present time many such positions are available and consequently it is right that the young surgeon shall accumulate a large experience in the service as an assistant of an older experienced surgeon before taking the responsibility of independent surgical work of a serious character in which his inexperience might endanger the life or health of the patient. It is, therefore, right that the College should require experience as one of the qualifications for Fellowship.

**Human interest.** No surgeon can become a useful member of society unless he shows human interest in those who entrust themselves to his care.

A selfish surgeon lacking human interest is a menace to a community and does not deserve the prestige given him by Fellowship in the College.

**Industry.** Unless a surgeon is industrious he will soon become inefficient because he does not keep up with the advances of the surgical profession. Such a member of the profession has no right to enjoy the benefits of Fellowship. His example is especially harmful for the development of the younger generation of surgeons.

**Ethics.** In order to build up the surgical profession of a community it is important that the ethical relations toward other surgeons and to the public be correct.

There is a close relationship between the first and last requirements. A surgeon who is absolutely honest can not well be unethical and vice versa; but there are certain relations, in which custom plays an important part, which introduces a difference.

Ethical conduct implies honesty, fair play and consideration for the other person's interests. It represents the practical application of the Golden Rule both to colleague and client which is often not an easy matter especially in a profession in which the element of competition is so important a part as in the practice of surgery.

There was a time when many of the most honorable members of the surgical profession felt that in order to deal fairly with the practitioner who referred patients to them a portion of the fee should be paid to the practitioner. The result of this, however, proved most pernicious, because it developed a form of barter in human life. In



many instances the practitioner referred the patient not to the most competent surgeon but to the one who was willing to pay the highest percentage of the fee collected, without regard for his learning, experience, skill, and judgment. This really meant nothing more nor less than barter in human life.

The American College of Surgeons demands of applicants for Fellowship that they be not guilty of this practice and will not be in the future. It makes the practice of splitting of fees in any form an absolute reason for preventing the admission to the American College of Surgeons on the one hand, and a cause for expulsion from the College on the other.

In the large as well as in small communities it is true to human nature that professional jealousy should exist, but the college has a right to expect its Fellows to put aside all personal differences and to support for Fellowship every colleague who possesses the required qualifications without regard to personal likes or dislikes. It would be quite as reprehensible to recommend for Fellowship a friend lacking the proper qualifications as it would be to oppose a candidate possessing these qualifications because of a personal dislike.

It is the duty of every Fellow to encourage young surgeons in the acquisition of the necessary qualifications, because it is exceedingly important to this country to give proper development to the next generation of surgeons.

Selfishness has no place in the acceptance or rejection of candidates for Fellowship.

### HISTORIES

The College demands from each applicant that he submit a sufficient number of histories of important cases treated to convince the examining committee that the applicant make it his practice to give each patient that comes under his treatment a careful physical examination, that he give proper consideration to the clinical history, that he make the necessary laboratory examinations, that he invite consultation when

necessary, that he plan the necessary treatment or operations carefully and avoid unnecessary operations, that he show proper surgical judgment and skill in performing the operation, that he record postoperatively conditions and end results.

It seems that there can be no method more favorable than this to determine a basis upon which the College can base its judgment for vouching to the public that the surgeon has proper scientific and technical qualifications.

It must be remembered that carelessness on the part of the College in admitting surgeons to Fellowship might cause great harm to the public, because the public has learned to trust their lives in the hands of the Fellows of the College. That a surgeon is not a Fellow of the College does not necessarily mean that he is incompetent or dishonest. There are nearly two thousand surgeons who have applied for Fellowship whose credentials have not convinced the committees that they are competent for admission to Fellowship. No doubt in many of these cases the defects in the records will be cleared up and they will later be admitted, but before they can be admitted your committees must be convinced that all of the requirements have been fulfilled. There are many young surgeons with splendid training who are looking forward to Fellowship as soon as they have acquired the necessary experience. The fact that these are not Fellows at the present time is no discredit to them so long as they are striving in an honorable way to acquire the necessary qualifications.

It is the duty of the Fellows to inspire these young men with the ideals of the College so that they may in due time strengthen the organization.

To the public the American College of Surgeons must mean that its Fellows can be trusted because of their honesty, their learning, their experience, their skill, their human interest, and their ethical appreciation of the Golden Rule.

Fellowship in the American College of Surgeons must mean that every surgeon who has this distinction deserves the absolute confidence of the community in which he lives.

## THE COMMITTEE ON THE TREATMENT OF FRACTURES

It is the desire of the Committee on the Treatment of Fractures of the American College of Surgeons that any Fellows of the College who may have constructive ideas concerning the work of this committee or who have been doing special work on fractures should communicate with the chairman, Dr. Charles L. Scudder, 144 Common

wealth Avenue, Boston, Massachusetts. The committee is particularly anxious to have definite ideas and suggestions presented to them in order that the work may be more rapidly developed. (For detailed statement regarding the work of the committee, see pp. 30 and 51 of the 1924 Year Book of the American College of Surgeons.)



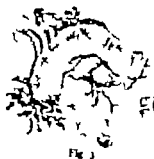


PLATE I—(See legends on opposite page.)

*Ben gu and Mal gu: Endometrial Implants in the Peritoneal Cavity—John A. Sampson*

# SURGERY, GYNECOLOGY AND OBSTETRICS

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## BENIGN AND MALIGNANT ENDOMETRIAL IMPLANTS IN THE PERITONEAL CAVITY AND THEIR RELATION TO CERTAIN OVARIAN TUMORS

By JOHN A. SAMPTON, M.D., F.A.C.S., ALBANY, NEW YORK

From the Gynecological and Pathological Departments of the Albany Hospital and of Union University (Albany Medical College)

THE surgeon has a wonderful opportunity to study living pathology<sup>1</sup> in both the early and the advanced stages of disease which unfortunately the pathologist, working in the laboratory rarely sees, except in experimental work on the lower animals. Two questions should arise in the mind of the surgeon observing a patient with a new-growth of any kind. First, what is the nature of the tumor and secondly how did the condition present arise? He has a responsibility and likewise an opportunity both to try to relieve the patient and also to in-

crease his knowledge of the subject. His first duty is to the patient but the attempt to increase his knowledge of living pathology need not necessarily interfere with the welfare of individual patients, and the sum total of his observations may be of great value both to the patient under observation and also to others.

When a surgeon cures or even temporarily relieves a patient with a malignant growth, he rejoices. If the operation or treatment is followed by an extension of the growth greater than the natural course of the disease he

### PLATE I

Fig. 3. The left tube and ovary shown in Figure 1 with an implant on the suspensory ligament of the ovary (natural size). The red raspberry appearance of the implant is due to recent hemorrhage for its histological structure see Figure 4.

Fig. 4. Colored photomicrograph (X60) of section of the implant shown in Figure 3 (hematoxylin and eosin stain). It is similar to dilated uterine gland with a color stroma resembling that of the endometrium, about as hemorrhage has occurred in its human form or the latter phase of such an implant see Figure 5.

Fig. 5. (A. H. No. 8836.) Right tube and ovary, the latter turned up, showing implants on its lateral surface (natural size). Implants are present on both ovaries the posterior surface of the uterus and the uterine duct. One of its epiploic appendages. For histological structure of the implants on the surface of the right ovary and the invasion of the epiploic appendage see Figures 6, 7 and 8. The patient, age 34.7. She had had one child 10 years ago. The uterus as retroflected. Operation was on the day after menstruation had ceased. The distribution of these implants suggests common origin and

could be accounted for by epithelium escaping through the tubes.

Fig. 6. Colored photomicrograph (X60) of section through one of the implants shown in Figure 5. Hemorrhage is present in the tissue about the glands and the latter have invaded the ovary.

Fig. 7. Under surface of the right ovary shown in Figure 5. The implants are larger than those illustrated in Figures 3 and 5 and have purple raspberry appearance (natural size).

Fig. 8. (A. H. No. 8836.) Endometrial implants in the cul-de-sac forming the anterior wall of the rectum to the posterior wall of the cervix uteri (natural size) from colored sketch made at the operation. The pigmented areas with blueberry coloring are due to an older hemorrhage about the endometrial tissue than that shown in Figures 3, 5 and 8.

Similar implants are present on the under surface of both ovaries. The patient is 37 years old, single, the uterus as retroflected and the induration in the cul-de-sac caused by the implantation as easily detected prior to the operation. Operation was 6 days after the last menstrual flow.



Fig. 3



Fig. 4



Fig. 5



Fig. 6

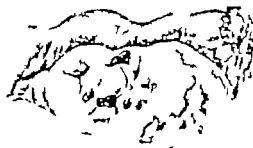


Fig. 7

PLATE I—(See legends on opposite page.)

*Benign and Malignant Endometrial Implants in the Peritoneal*

*Cavity*

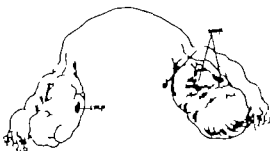


Fig 7 (A. H. No. 87866) Endometrial implants seen on the undersurface of both ovaries and on the posterior surface of the right broad ligament bearing the uterine tube. Posterior view of the uterus, tubes, and ovaries; the latter turned upward in order to show the implants ( $\times 16$ ) (See Figs 8 and 9). The patient, age was 38. She had had one child 4 years ago. The uterus was retroflected. Operation was at the onset of the menstrual period.



Fig 9 Photomicrographs ( $\times 5$ ) of section of the implant on the posterior surface of the broad ligament and also of one of those on the surface of the right ovary shown in Figures 7 and 8. At *a*, small (young) implant is indicated and *b* an older one both on the surface of the broad ligament. Implant *b* has invaded the underlying tissues developing into miniature endometrial cavity (Compare with Fig. 7). The implant on the surface of the ovary (the lower photomicrograph) presents condition somewhat similar to that shown at *b*.

dominal operations for pelvic disease in women between 30 and 50 years of age and 6 additional cases, 3 under 30 years of age and 3 over 50. During the year May 1, 1922 to May 1, 1923 (also representing a little less than 11 operative months) 64 patients with these lesions were encountered in 206 operations similar to the above. Of the patients between 30 and 50 years of age the lesion was found 52 times in 198 operations; of those under 30, 9 times in 59 operations; and of those over 50, 3 times in 39 operations. The youngest patient in these two series was 22 years old.

As previously stated (1) should the tissue escaping through the fallopian tubes into the peritoneal cavity fall on suitable soil it would develop into glands or tubules of endometrial type, which usually react to menstruation. These endometrial implants are most frequently found on the pelvic structures which would naturally be reached by material escaping through the tubes, as both the pelvic peritoneum and the lateral and under surfaces of the ovaries, or only the pelvic peritoneum, or only the ovaries. Pigmentation due to haemorrhage (menstruation) is nearly always present in the tissues of these implants and this with their other features (Figs 3, 5, 8, 10, 13, 14, and 16) permits them to be easily recognized at operation.

The primary peritoneal implants are usually small and are easily overlooked by the operator who is not familiar with them. How-

ever they sometimes spread and become invasive. The implants on the ovary are usually much more active than those lodged on the peritoneum and often invade the tissues of that organ. As a result of their growth combined with their reaction to menstruation they frequently develop into superficial or deep haematomata (haemorrhagic menstruating or chocolate cysts) of endometrial type. Perforation often occurs in the superficial haemorrhagic cysts while they are still small a few millimeters in diameter. The haemorrhagic cysts developing in the deeper tissues of the ovary may reach several centimeters in size (the largest one observed was about 15 centimeters in diameter). Repeated perforations may occur. Many interesting histological changes occur in the wall of the ovarian haematomata in their reaction to menstruation (Figs 19 and 20) and the at-



Fig. 3 Photomicrograph (X60) of section through one of the pigmented elevations show in Figure 10. It consists of typical endometrial tissue with normal-sized and dilated glands. Hemorrhage is present in the tissues about the glands and between the uterine lining, causing the pigmented appearance shown in Figure 10.

tempted epithelial repair following it. As this repair is attended with difficulty the usual ultimate tendency of these cysts is one of retrogression.

Any endometrial implant wherever situated may not only invade the tissues on which it primarily develops, but may also invade adjacent structures with which it comes in contact. In the reaction to menstruation epithelium may also be cast off and give rise to other implants. The perforation of the



Fig. 4 (A II No 8146) Condition found at operation in patient with multiple leucocystoma and endometrial implants on the surface of both ovaries, the posterior surface of the uterus, the terminal loop of the ileum, and the sigmoid (X10). An ovarian hematoma of endometrial type—centimeters in diameter was present in the left ovary which possibly had perforated. It is impossible to state whether all the implants are primarily derived from epithelium escaping through the tubes, or whether some may be derived from other implants, especially from perforation of the ovarian hematomas. The patient was 37 years old, married, but had never been pregnant. The operation was weeks after the last menstrual flow.

#### PLATE II

Fig. 5 Left tube and ovary (shown in Fig. 1) the ovary turned upward exposing its lateral surface (natural size). The pigmentation ("blueberry" coloring) is due to hemorrhage in the endometrial tissue implanted on the surface of the ovary. The position of the bestrated end of the patient tube which is adherent to the lateral surface of the ovary indicates source for these implants namely epithelium escaping through the tube. For the histological structure of some of these implants see Figure 3.

Fig. 6 Endometrial implants on the terminal loop of the ileum shown in Figure 1 from Leitch, natural size made at the operation. These are not excised but are identical in their appearance with those situated on the ovaries which are examined macroscopically. Compare also with Figure 3 showing the implant on the small intestine from malignant tumor of the endometrium.

Fig. 7 Colored photomicrograph (X 5) of section through the implant on the surface of the ovary shown in Figure 3. These consist of glands of endometrial type with evidence of old and recent hemorrhage in the tissue about them. The glands have invaded the tissues of the ovary and small endometrial cyst is present in the

left. Each I believe, arose from these glands as did also the hematomas or hemorrhagic cyst of the same ovary (left) shown in Figure 1.

Fig. 8 (A II No 8009) A portion of the lateral surface of the right ovary with pigmented elevations on its surface due to hemorrhage and the tissues of an endometrial implant (natural size). The fresh hemorrhage (red) is due to trauma from the manipulations of the operation. The patient—30 years old, single, the uterus was greatly enlarged due to multiple leucocystoma. Implants are present on the surface of both ovaries and in the cul-de-sac. The right ovary contained hematoma of endometrial type about 4 centimeters in diameter which had perforated. Operation was weeks after the last menstrual flow. For the histological structure of the implant see the next illustration.

Fig. 9 Colored photomicrograph (X 5) of section through the implant, taken from the right ovary shown in Figure 8. Endometrial tissue is present with normal-sized and dilated glandular spaces and old and recent hemorrhage in the tissues about the glands and in the lamina of the same.



Fig. 8



Fig. 14

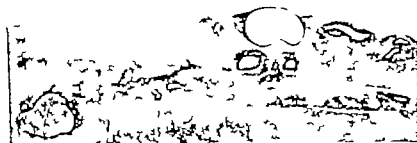


Fig. 5



Fig. 16

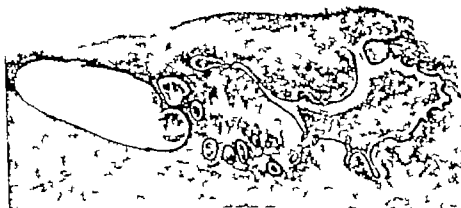


Fig. 7

PLATE II — (See legends on opposite page.)

*Benign and Malignant Endometrial Implants in the Peritoneal Cavity—John A. Sampson*





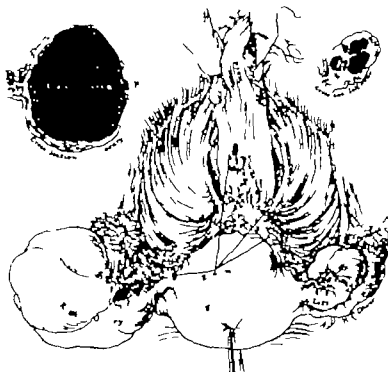


Fig. 8 (A. H. N. 86449) A large endometrial hematoma (about 6 centimeters in diameter) of the right ovary with evidence of previous perforation, & multiple small endometrial hematomata of the left ovary also endometrial implants invading the posterior surfaces of both broad ligaments, the uterus, and the anterior wall of the rectosigmoid, fusing the uterus with the latter. The condition found at the operation, after freeing the ovaries and partially separating the uterus from the large intestine ( $\times 34$ ).

I believe that the ovarian hematomata arise from epithelium escaping through the tubes, becoming implanted on the surface of the ovaries, and developing into menstruating endometrial cysts. The implant on the surface of the broad ligaments, the uterus, and the large intestine may have been derived primarily from epithelium escaping through the tubes, or from the perforation of the ovarian hematomata. The ovarian hematomata may be considered as hot bed or redistributing focus in the origin of these implants. The uterus contained multiple leiomyomata and an endometrial polyp. The patient, 47 years old, married, but never pregnant, the operation was just before the next menstrual flow. (See Figs. 9, 10, and 11.)

ovarian hematomata, whether small or large, is apparently the chief source of these secondary growths. The ovary may be considered an incubator, hot bed, redistributing focus, or even intermediary host in the origin of these secondary implants, which in some instances may possibly impart greater activity (virulence) to the epithelium developing in it. This latter faculty while apparently present is difficult to estimate, as there is such a great variation in the degree of invasiveness of the implants in different cases. Many are small and chiefly of histological interest, while

others may simulate malignancy in both their clinical and gross pathological manifestations. In some instances only primary implants are present, while in others these are both primary and secondary. When an ovarian hematoma is present, with evidence of a previous perforation, and is associated with adhesions and an endometrial invasion of the tissues involved in these adhesions, the endometrial tissue of the latter would seem to have arisen from epithelium carried with the contents of the hematoma escaping through the perforation (Figs. 18 and 21).



Fig. 3. Photomicrograph (X60) of section I, posterior of the posterior uterine wall (Fig. 3). Typical endometrial tissue has invaded the uterine wall causing so-called adenomyoma of the uterus from endometrial tissue implanted on the peritoneal surface of the organ. This implant was derived either from tissue passing through the tubes, primary growth or secondary growth on the perforation of the ovarian hematoma.

The distribution of the implant in these cases is similar to that associated with malignant ovarian tumors except that the latter are usually much more extensive. I have never found benign endometrial implant in the omentum which is so often involved in patient with peritoneal carcinoma.

This series of 64 cases of endometrial implantation and the condition arising from them admit of the following classification:

1. Small implant involving both the surface of the ovary or ovaries and the other structures in the pelvis (18 cases). The implant involving the ovary were usually found on their lateral and under surface (Figs. 5, 8 and 11). Those on the peritoneum were usually multiple and most often on the posterior surface of the uterus, the broad ligaments, and in the cul-de-sac especially about the uterine attachment of the uterosacral ligaments (Figs. 2 and 10). They were also encountered on all the structures in the pelvic cavity excepting the omentum and the bladder.

2. Small implants in the structures in the pelvis similar to those just mentioned but without any demonstrable ovarian lesion (8 cases).

3. Small implants on the surface of the ovary or ovaries without any evident peritoneal involvement (9 cases).

4. Ovarian hematomata from 5 millimeter to 15 centimeters in diameter (18 cases). The majority of these had apparently perforated and were adherent at the site of perforation to various adjacent structures. They were also associated with other adhesions apparently resulting from the escape of the content of the hematoma into the pelvic cavity. Furthermore there was usually peritoneal implantation of greater extent and a deeper endometrial invasion of the underlying structures than in the previous groups (Fig. 18). In one case the perforation had extended through the posterior layer of the right broad ligament to which the ovarian hematoma was adherent, and endometrial tubules were found invading the tissues between the layers of the broad ligament. An "adenomyoma" was present in the groin in this case. It was attached to the round ligament of the same side as the ovarian hematoma, suggesting that the endometrial tissue had reached the groin through the round ligament by metastasis or direct extension. Another instance of "adenomyoma" in the groin was found but without demonstrable implantation lesions in the pelvis.

Intestinal implants were present in 15 patients. The rectosigmoid was involved in 11, the sigmoid and small intestine in 1 and the caecum in another instance. The appendix was not found involved in this series of cases as in previous ones. Of the 45 cases in which ovarian lesion were present both ovaries were involved in 18.

All of the ovarian lesions were examined macroscopically, the ovary or ovaries having been removed or the area involved excised. In every instance in which peritoneal implants were found a specimen was examined macroscopically, but all implants were not removed in every instance. Only two of the intestinal implants were removed, both in epiploic appendages of the sigmoid. In the other cases the intestinal lesions were of a gross appearance corresponding with that of the other peritoneal implants which were present and were removed. In no instance did I think that

intestinal resection or excision of a piece of the wall of the intestine was justifiable.

The life history (1) of the ovarian hematoma, the intestinal lesions (2) resulting from endometrial implants and the clinical features (3 and 4) of these conditions, have been discussed in previous paper. Further studies have strengthened the views expressed in these articles, with minor changes resulting from a better knowledge of the subject.

#### THE ORIGIN OF ENDOMETRIAL IMPLANTS

The microscopic study of menstrual blood shows that it may sometimes contain not only epithelium cast off by menstruation but also bits of endometrial stroma. Occasionally blood may be observed escaping from the fimbriated ends of the fallopian tubes of patients operated upon during the menstrual period. The question naturally arises: Does this blood come from a back flow from the uterine cavity or from portions of the tubal mucosa which have reacted to menstruation? I believe that it may arise from both sources but more frequently from the uterine cavity. The reaction of tubal mucosa to menstruation giving rise to an appreciable flow of blood is probably infrequent otherwise hematosalpinx would be a more common condition as compared with hydrosalpinx. Irrespective of the source of the blood (whether uterine or tubal) which escapes into the peritoneal cavity at this time we know that it may contain epithelium cast off by the menstrual process. I have found epithelium both in the lumen of the tube and in blood escaping from it.

The primary endometrial implants are most often found on the structures in close anatomical contact with the fimbriated ends of the tubes, and less frequently on more remote structures which would not as readily be reached by blood escaping through the tubes into the peritoneal cavity as has already been discussed. All this is circumstantial evidence as to the primary origin of these implants. The one positive proof that endometrial tissue may become implanted and grow in human beings is the development of adenomyomata in the scar of the abdominal incision, after operations in which the uterine cavity has been opened. I have referred to two such in-

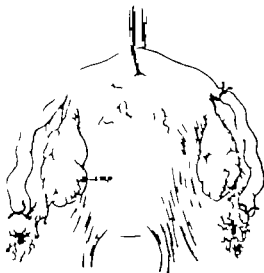


Fig. Patient (A. H. N. 85661) age 44, single, no history of very profuse menstruation and previous curettage with only temporary relief. The uterus as found to be irregularly enlarged and retroverted. The patient, as flowing at the time of the operation and blood could be seen escaping through the fimbriated end of both tubes. At the beginning of the operation the fimbriated end of the left tube and both the fimbriated and the uterine ends of the right tube were ligated (illustration  $\frac{1}{2}$  natural size). The uterus, left tube and ovary and the right tube were removed and hardened in formalin. Sections made from both tubes showed blood and epithelial cells, greater amount as found in the left tube, as could be expected. An endometrial implant, *mp*, as present on the under surface of the left ovary. For the histological structure of the uterine mucosa, the contents in the left tube, and of the endometrial implant on the ovary see Figures 3, 24, and 5.

stances in a paper (1) presented by me at the meeting of the American Gynecological Society in 1922. The specimens from these two cases had been examined by Dr. F. B. Mallory of Boston, Massachusetts. In the discussion of my paper Dr. T. S. Cullen (5) reported through Dr. C. F. Burnam three cases of adenomyoma in the scar of an abdominal incision. One of these cases followed an extensive operation for an adenomyomatous uterus and adenomyoma of the rectovaginal septum 8 years after the original operation. The other two cases followed ordinary cesarean section, one of them belonging to Dr. Albert L. Staveland of Washington and one to Dr. Ernest A. Codman, of Boston. The first case shows that it is possible to transplant adenomyoma and the other two indicate that ordinary uterine mucosa implanted into an abdominal incision can grow into a tumor.



The Photomicrograph (X60 of section) of portion of the posterior uterine wall. Typical endometrial tissue has invaded the uterine wall causing so-called adenomyoma of the uterus, from endometrial tissue implanted on the peritoneal surface of that organ. The implant was derived either from tissue exsurgence through the tubes, primary growth, or secondary one from the perforation of the ovarian hematoma.

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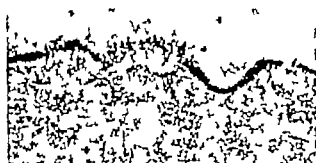


Fig. 9



Fig. 20



Fig. 3



Fig. 24

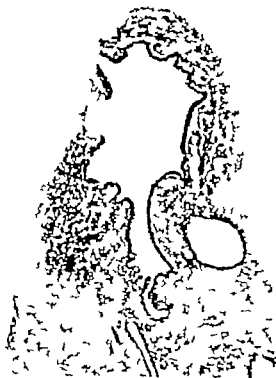


Fig. 5

PLATE III — See legends on opposite page

BENIGN AND MALIGNANT ENDOMETRIAL IMPLANT WITH PERITONEAL CARCINOMA — JOURNAL OF SURGERY



of patients operated upon during menstruation (Fig. 22). The microscopic examination of this blood may show epithelial cells. The histological study of sections of the tubes may also show epithelium and bits of endometrial stroma lying free in the lumen of the tube (Fig. 24).

7 As the study of ectopic endometrial tissue in the pelvis demonstrates that implants may sometimes arise from this, it is natural to assume an implantation origin for the former if a source could be found. Menstrual blood escaping through the tubes indicates a source.

8 They are often found in different stages of development in the same individual thus suggesting repeated implantations from the original source or from other implants.

9 The early implants are found on structures in the pelvis which would naturally be reached by blood escaping through the tubes and they are most frequent on the structures in close anatomical relation with the fimbriated ends of the tubes. They may be present only on the peritoneum or only on the ovaries but are usually found on both. Their distribution is often bilateral as occurs in pelvic inflammatory lesions of tubal origin.

10 Similar growths have been observed in the scar of the abdominal incision of patients in whom the uterine cavity has been opened, thus affording the opportunity of implanting bits of uterine mucosa in the tissues of the abdominal incision.

11 Jacobson has reproduced lesions similar in many respects by the auto transplantation of bits of the uterine mucosa of the rabbit into the tissues of the pelvis.

The question naturally arises, what are the conditions which would favor the escape of menstrual blood from the uterine cavity through the tubes? This would readily occur in women with patent tubes of large caliber especially in the interstitial portion of the fallopian tubes, when the uterus was relaxed and when there was any interference with the escape of menstrual blood through the cervix. The damming back of menstrual blood in the uterine cavity might be caused by many conditions, such as clots of blood and pieces of tissue occluding the cervical canal, and pos-

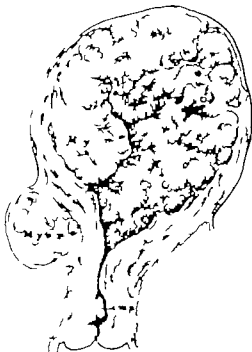


Fig. 26. Sagittal section of uterus with extensive adenocarcinoma of the body and multiple leiomyomata. (X95).  
Case. Carcinoma was also present in the left tube either as primary growth or secondary to that of the uterus, from bits of cancer escaping from the uterine cavity into the lumen of the tubes and becoming implanted on the tubal mucosa. (Figs. 28 and 29). An implantation carcinoma was present in the cervix, esp. and also in the vagina (see text of article).

sibly by retroflexion of the uterus and leiomyomata and polyps which encroach upon the uterine cavity. Reverse uterine contractions might force the fluid contents of the uterine cavity into the tubes. Probably a very important factor is a large caliber of the interstitial portion of the fallopian tubes. This varies greatly in different women and also probably in the same individual under different conditions. During the years 1916 and 1917 I was greatly interested in the shape of the uterine cavity in normal and pathological conditions. This was determined by injecting melted gelatine containing bismuth subcarbonate or barium sulphate in suspension through the cervix of the uterus removed at operation, or obtained at autopsy. After the solution had become solidified, by placing the specimen in cold water. X rays of it were





Fig. 28. Photomicrograph (X60) of a portion of a tube just back of the fundus and distal to the ligature. Carcinoma apparently arising from the tubal mucosa is present and is of the same type that found in the uterus. This growth is continuous with that shown proper are through the dilated opening in Figure 27. Cells have arisen from the implantation of bits of cancer escaping from the uterine cavity into the lumen of the tube? (See Fig. 29) Cancer is not found in the deeper structures of this tube but is present in the lining of the adjacent tube. (See Fig. 29)

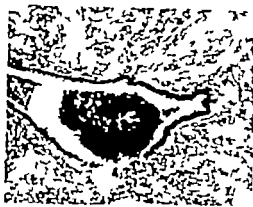


Fig. 29. Photomicrograph (X60) of a portion of the tube near the uterus. Fragment of cancer is found free in the lumen of the tube. It is impossible to state whether they are derived from the growth in the tube or from the uterine cavity. One of these fragments is shown. Different tubal mucosa, destroying the underlying tubal epithelium and invading it, demonstrating that this fragment may become implanted on tubal mucosa.

#### THE CLINICAL FEATURES OF BENIGN ENDOMETRIAL IMPLANTS AND THE CONDITIONS RESULTING FROM THEM

male. While filling the uterine cavity with this injection mass, some of it would escape through the tubes if the latter were patent, but the force (pressure) required to cause this varied greatly in different specimens; just as has been found in testing the patency of the tubes by the Rubin method. These tubes furnished the material for a paper (7) which I presented at the meeting of the American Gynecological Society in 1918 on the escape of foreign material from the uterine cavity into the uterine vein and through the tubes. The roentgenographs made at that time showed that there was a great variation in the diameter of the lumen of tubes, especially of the interstitial portion in different specimens. Some were very narrow and others comparatively wide as shown in the illustrations of the above mentioned paper. I believe that if all women had tubes with a lumen of wide diameter in their interstitial portion menstrual blood would escape much more frequently into the peritoneal cavity and endometrial implantation would be of even greater frequency.

These implants are usually small and slow growing and therefore do not give rise to any symptom in the majority of cases. They are most often encountered in operations for leiomyoma and retroflexion of the uterus especially in nulliparous patients as well as in operations primarily undertaken for the relief of condition resulting from endometrial implantation. They are rarely found at operation for conditions resulting from tubal infection and the injuries of childbirth. Their influence on pregnancy on these implants is a very interesting one. Apparently it lessens their incidence and the subsequent involutary changes may possibly retard the further development or even cause the retrogression of any implant present. Meigs (8) has suggested that lactation atrophy which the uterus frequently undergoes during the nursing period may cause small implant to disappear. In 45 of the 64 cases referred to in this series the implant were small and without any symptoms referable to them at the time of the operation. I believe that in a few of these 45 cases, the further progress of the disease might have caused discomfort. In 19

of the patients the conditions resulting from the implantation was either the sole or a contributory cause of the patient's discomfort. These symptoms arise chiefly from the reaction of the implants to menstruation, from the adhesions resulting from them and from the invasion of the large intestine. Patients with ovarian hematomata or extensive implantation in the cul-de-sac, or both, usually present a very definite clinical picture capable of diagnosis before operation in the majority of cases. The age of the patient (usually between 30 and the menopause) the acquired dysmenorrhoea or increase in menstrual pain (the disturbance of intestinal function during menstruation if some portion of the intestinal tract is involved) the detection of a small adherent ovarian cyst or adherent ovary or ovaries and the palpatory findings in the cul-de-sac (due to implants in this situation) present a syndrome rarely furnished by any other condition. When the perforation of an ovarian hematoma is associated with the escape of a large amount of its contents into the peritoneal cavity the condition arising may simulate an attack of peritonitis.

The primary peritoneal implants as a whole usually remain small and do not cause trouble but occasionally spread and become invasive. The implants on the ovaries are usually much more active and frequently invade that organ and develop into menstruating ovarian cysts or hematomata, which as a rule are small a few millimeters to 3 or 4 centimeters in diameter but occasionally reach a large size (the largest I have encountered was about 15 centimeters in diameter). Whether small or large they usually perforate as a result of their reaction to menstruation, causing adhesions and further implantation. All the implants and the endometrial structures arising from them are influenced by ovarian function and react as does the mucosa of the uterine cavity to menstruation, pregnancy and the menopause, whether the latter is natural or acquired. The operative treatment of this condition must in a large measure, be determined by a knowledge of the natural course of the disease which has just been outlined. It must also be adapted to other conditions which

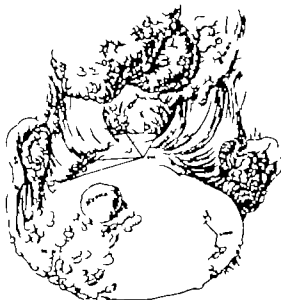


Fig. 30 (Case ) Malignant endometrial implants (sarcoma) diffusely distributed throughout the pelvis and abdominal cavity associated with large endometrial tumor of the uterus apparent stromal cell sarcoma and also small papillary adenocarcinoma of the uterus, the implants apparently primarily arising from tissue escaping through the tubes the condition found at operation after exposing the pelvic contents and drawing the uterus upward and forward ( $\times 3/4$ ). The uterus is enlarged. The implants are generally distributed but are more numerous in some locations than in others, and were all of the same histological structure as the large tumor of the uterus. Both tubes are patent and fragments of the malignant tumor are found lying free in the lumen of one of them (Fig. 36). These facts together with the distribution of the implants, indicate that they primarily arose from fragments of the malignant tumor of the uterus escaping through the tubes.

may be associated with it and to the desire on the part of the patient for conservative surgery. When ovarian conservation is not to be considered the operation indicated is the removal of all ovarian tissue and the correction of whatever lesion is present, whether from implantation or associated conditions. I believe that intestinal resection is rarely required as the endometrial tissue in the intestine should atrophy after all ovarian tissue has been removed. There may be an occasional exception to this rule.

The great problem is what shall be done when conservative surgery is desired. In encountering small implants at operation in these cases, I always excise those in the ovary or ovaries or remove only one ovary and also



Fig. 33 (Case 2) Photomicrograph (X60) showing portion of one of the larger implants (Fig. 33) in adhesion to the ovary from its surface. The histological structure of the implant is similar to that of the large uterine tumor (Figs. 34 and 35) and also to the fragments of the tumor found free in the lumen of the tube (Fig. 36).

excise the peritoneal implants which may readily be removed. In addition an attempt is made to lessen the chance of further implantation by dilating the cervix and correcting any uterine displacement in patients desiring children or by the removal of the tubes when future pregnancy is not to be considered. I believe that it is of the greatest importance to examine the ovaries carefully in all abdominal operations for pelvic conditions and remove any implants found, to prevent the possible future development of ovarian hematomata or even malignant ovarian tumors. The results of ovarian conservation in these cases will not be uniformly good but it should be thoroughly tried out. Two of my patients whom I have thus treated have subsequently become pregnant, one aborted and the other is the proud mother of a living child. Both women were very anxious to have children. In two others that I have recently examined there is evidence of implantation in the cul-de-sac and the patients have not been entirely relieved. It is difficult to determine whether the lesion present in these two cases is the result of my not having completely removed all ectopic endometrial tissue present at the operation or whether there may not have been other deposits from epithelium escaping through the tubes subsequent to the operation. It is also possible that in the

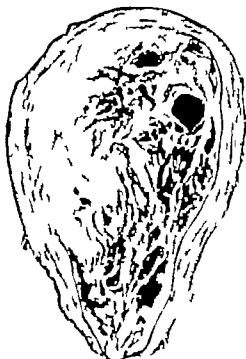


Fig. 34 (Case 2) Sagittal section of the uterus showing large endometrial tumor filling and distending the uterine cavity (X15). It has the gross appearance of soft brown, waxy or sarcoma, with areas of necrosis and resistant cavity formation.

excision of dormant implants particles left behind may have been stimulated to further activity.

Where ovarian hematomata are found with extensive peritoneal implantation and endometrial invasion of underlying structures, ovarian conservation (even though desired) is attended with a greater risk of not relieving the patient, but a second operation can always be done if necessary. I believe that conservative surgery in this group should be employed only in selected cases.

#### MALIGNANT IMPLANTS OF ENDOMETRIAL TYPE SECONDARY TO MALIGNANT TUMORS OF THE UTERINE MUCOSA AND ARISING FROM CELLS ESCAPING FROM THE UTERINE CAVITY THROUGH THE TUBES

As normal endometrial epithelium and stroma at times escape from the uterine cavity through the tubes during menstruation and



Fig 35 (Case ) Photomicrograph ( $\times 3$ ) of section through the surface of portion of the large uterine tumor. Blood in the uterine cavity containing bits of the tumor might at times escape through the lumen of the tubes and give rise to the implants. Sections of this tumor with its junction with the normal endometrium were similar to the one shown in Figure 4.

give rise to endometrial implants invading the pelvic structures and as the implants invading the ovary may develop into endometrial cysts which are often bilateral and may at times reach a size of 10 to 15 centimeters in diameter we should expect that similar peritoneal implantation and likewise malignant ovarian tumors would arise from cells escaping through the tubes from malignant tumors of the uterine mucosa. We should expect a similar primary distribution of the implants in the two groups of cases, and also that the malignant implants would grow more rapidly and give rise to more extensive secondary implantation. This is all true and we may go a step further in the study of the origin of malignant and benign epithelial ovarian tumors. As endometrial implants in the ovary are of common occurrence (observed in 45 of 296 abdominal operations for pelvic disease in year) we would naturally infer that this tissue might undergo malignant changes and thus be a source of malignant ovarian tumors. This I have observed. It is also rational to believe that tubal and endometrial epithelium implanted in the ovary might be a source of varieties of ovarian tumors other than the typical menstruating endometrial cysts.



Fig 36 (Case ) Photomicrograph ( $\times 60$ ) of section of portion of the left tube showing a piece of the malignant tumor lying free in the lumen of the latter. It is of the same histological structure as the large uterine tumor and of the implants and I believe indicates the venue by which the latter arose.

I have seen only 5 cases of malignant ovarian tumors associated with and of the same



Fig 37 (Case ) Photomicrograph ( $\times 5$ ) showing typical papillary adenocarcinoma. A small area of thickened endometrium as found lateral to the large tumor. The section from which this photomicrograph was made was taken from this area. Possibly further study of the specimen will show other areas of adenocarcinoma. Two varieties of malignant endometrial tumors were possibly present in this specimen: the larger one is apparently stromal cell sarcoma (Figs 34 and 35) and the smaller papillary adenocarcinoma. The implants arose from the former.



Fig. 29. Case 3. Implantation carcinoma on the posterior surface of the uterus, both broad ligaments, cul de sac, sigmoid, omentum, and left ovary. Associated adenocarcinoma of the body of the uterus and possibly an endometrial sarcoma. The condition found at operation after exposing the pelvic contents. I draw the uterus upward and forward ( $\times 1$ ). The uterus is slightly enlarged. The distribution of the implant is shown and is similar to that often found in benign endometrial implantation (Fig. 1). They were all of the glanglioid type. Both tubes are patent part less of cancer are not found in the lumen of the tubes but the distribution of the implant and the knowledge gained from the study of benign and other malignant implant would indicate that they primarily arose from malignant tissue escaping through the tubes.

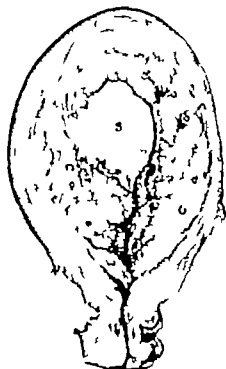


Fig. 30. Case 3. Sagittal section of the uterus (sagittal view). The uterine cavity is divided by typical adenocarcinoma of the glanglioid type except for portion indicated by black bar the gross appearance of adenocarcinoma lesion more but is more homogeneous and after histologically it is very cellular, least gland formation (Figs. 2 and 4).

histological structure of the malignant tumor of the accompanying uterus. Three of these 5 cases were observed during the last year when I was especially interested in the subject. Meigs (9) in a recent report of 44 cases of adenocarcinoma of the body of the uterus operated upon at the Free Hospital for Women in Brookline, Massachusetts describes five specimens in which metastases were found in one or both ovaries.

The question naturally arises, why does it not occur more often? Three explanations can be offered for the infrequency of implantations arising from cancer escaping through the lumen of the tubes in these cases. Carcinoma of the body of the uterus occurs most frequently in women after the menopause when the tubes are smaller with a consequent diminution in the caliber of their lumen,

which would not readily permit material to escape through them from the cavity of the uterus as in younger women. Twenty-nine of the 44 patients reported by Meigs were over 50 years of age and the average age of 186 patients with carcinoma of the body of the uterus, recently reported by Mahle (10) from the Mayo Clinic was over 55 years. The growth in the uterine cavity may also occlude the uterine openings of the tubes thus preventing material suspended in blood in the uterine cavity from escaping into the lumen of the latter or if cancer cells escaped into the peritoneal cavity conditions were not favorable for their growth.

The following 4 cases are of interest as demonstrating the dissemination of malignant tumors of the uterine mucosa from tissue apparently escaping through the lumen of the tubes



Fig. 40. Case 3. Photomicrograph (X 5) of section through both the glandular and solid tumors shown in Figure 39. The left, typical adenocarcinoma arising from the endometrium is present and to the right, solid type of tumor (Fig. 39) also apparently arising from the endometrium (Fig. 4). In the center the normal endometrium is compressed laterally by the two tumors growing toward each other.



Fig. 41. Case 3. Photomicrograph (X 30) of the solid tumor at its junction with the normal endometrium. The tumor to the right is apparently arising from the stroma cells of the uterine mucosa or gradually replacing them so that it is impossible to draw a sharp line between the tumor cells and those of the endometrial stroma. It is either an endometrial sarcoma or an atypical solid phase of the adenocarcinoma. I am undecided which it is.

**CASE.** Carcinoma of the left fallopian tube associated with carcinoma of the body of the uterus and apparently arising from the implantation of cancerous tissue on the tubal mucosa.

A. H. No. 8934. The patient, age 62, complained of uterine bleeding. She had been married but had never been pregnant. Menstruation had always been profuse and she was unable to determine the date of the menopause as there had been more or less constant bleeding for the last years. She had been cured yearly before I saw her. Diagnosis of malignancy was made and the condition was considered inoperable. Since that time she had had repeated X-ray treatments. Pelvic examination showed the uterus to be irregularly enlarged and there was a small nodule about 8 millimeters in diameter in the anterior vaginal wall just beneath the urethra. The preoperative diagnosis was cancer of the body of the uterus with vaginal implantation. Operation was at the Albany Hospital, March 6, 1935. No gross evidence of peritoneal implantation was found, but the lower fimbriae of the left tube were adherent to the broad ligament and some of the fimbriae just to the opening were swollen and more opaque than the others, suggesting carcinoma (Fig. 7). A ligature was placed about both tubes near the fimbriated ends in order to prevent any cancerous tissue from being forced from the uterine cavity out through the tubes during the operation. The uterus, both tubes and ovaries were removed (Fig. 54). The growth in the vagina was excised and the vagina was treated with radium. The patient made a satisfactory convalescence.

The uterus (Fig. 26) contained an extensive adenocarcinoma of both the glandular and solid type.

Leiomyomas were also present. A carcinoma of the same type as that of the uterus was found in the distal end of the left fallopian tube, replacing the tubal mucosa (Fig. 38) and extending through the fimbriated opening (Fig. 7). The entire histological structure of this growth was that of one arising from the tubal mucosa or from growth implanted upon and replacing it and not from metastases through lymph vessels or veins. Bits of cancerous tissue were found lying free in the lumen of the tube between the ligature and the uterus. In one place a piece of this tissue was adherent to the tubal mucosa, destroying the tubal epithelium and replacing it, thus demonstrating the implanting of cancer on the mucosa (Fig. 39). The ovaries were examined histologically and no evidence of cancer was found. Cancer was not found in the lumen of the right tube, but was present in the lumen of the left tube wall. An implant of cancer was present in the cervical mucosa (Fig. 26). The nodule excised from the vaginal wall showed the same type of growth as that of the uterus.

It is not my purpose to discuss all the possible relations between the growth of the uterus and those of the tube, cervix, and vagina, but to present what seems to me to be a rational explanation of the origin of these secondary tumors. The uterus had been cured years before. As a result of the curettage and the manipulation of the uterus incident to it, bits of cancer were forced into the tube and became implanted on the tubal mucosa. The



FIG. 44. (A) photomicrograph of sections of the uterus and the malignant endometrial invasion of the appendage shown in Figures 43 and 45. The benign type (to the left) consists of normal-sized and dilated glands in places with small amount of tissue, but then resembling endometrial stroma, which in some areas is hemorrhagic with blood also present in the lumen of some of the glands. The connective tissue of the appendage is increased. The malignant type (to the right) also shows glands, the more superficial of which appear normal (Fig. 45)—but without any trace about them resembling endometrial stroma. As they penetrate more deeply into the appendage they become transformed into typical adenocarcinoma (Fig. 45). This picture suggests that either the latter implantation was primarily benign and is undergoing malignant change or else that the implanted cancer cells reverted to normal, first developing into glands of normal appearance and later manifesting their true character.

curette may have injured the cervical mucosa, thus permitting viable cancer cells, loosened by the curettage to develop in this situation. The implant in the vagina has a similar origin. The absence of any implant on the ovaries and peritoneum may be explained by assuming that cancer cells did not escape into the peritoneal cavity or if they did, conditions were not favorable for their growth.

**Case 2.** Malignant endometrial implants (sarcoma) diffusely distributed throughout the pelvis and abdominal cavity associated with large endometrial tumor of the uterus apparently trophoblastic sarcoma, and also a small papillary adenocarcinoma of the uterus, the implant apparently primarily arising from tissue escaping through the cervix.

**A. H. N. 87780.** The patient, age 54, single, complained of pain in the lower abdomen and uterine bleeding. Menstruation had been regular and normal. The menopause occurred at the age of 50. This last bleeding was of over a year's duration. Pelvic examination showed what appeared to be a polyp protruding from the cervix. The body of the uterus as such, was not recognized on bimanual palpation, but the pelvis was filled with a soft tumor (later shown to be the body of the uterus) extending upward into the abdominal cavity. Distinct nodules were felt in the cul-de-sac. The pre-operative diagnosis was malignant ovarian cyst. An implant in the cul-de-sac and a cervical polyp. Operation was at the Albany Hospital, December 6, 1900. On opening the abdominal cavity a greatly thickened omentum was found, lightly adherent over the surface of the pelvic tumor which proved to be an enlarged uterus. After freeing the omentum and exposing the pelvic contents (Fig. 30) many implant

were found on the surface of the fundus of the uterus, ovaries (Fig. 31) loops of small intestine (Fig. 32) sigmoid, and in the cul-de-sac. The uterus and both tubes and ovaries were removed. The patient reacted badly after the operation, with rapid pulse and elevation of temperature (symptoms of infection without those of peritonitis) and died on the fourth day. A uterine was performed by Dr. Jacobson. The distribution of the implants found by him was as just described. Metastases were not present in the lungs. No evidence of infection was found. A chronic fibrous myocarditis as the only pathological lesion present other than the malignant implants. On incising the enlarged uterus, the cavity was found to be filled by tumor arising from the endometrium of the anterior wall which had the gross appearance of soft subcutaneous leiomyoma or sarcoma, with areas of necrosis and resultant cystic formations (Fig. 34). The histological structure of this tumor resembled a sarcoma more than carcinoma (Fig. 35) and at its junction with the endometrium the tumor cells could be seen apparently arising from or replacing the stromal cells of the latter. (See also Figure 41, Case 3.) At one side of this tumor, small papillary growth was found arising from the endometrium, which histologically proved to be papillary adenocarcinoma (Fig. 37). My present reaction is that there were two types of malignant tumors in this uterus, an endometrial stromal cell sarcoma and an adenocarcinoma. Dr. Jacobson agrees with this diagnosis, but intends to make further study of the specimen.

All the implants studied were essentially alike and were similar in type to that of the large uterine tumor. No implants were found of the glandular type.

Both tubes were patent and bits of the growth were found free in the lumen of one of them (Fig.



Fig 45 Three photomicrographs (X35) the first showing normal gland and portion of a dilated gland of the benign endometrial implant of Figure 44 the second normal appearing gland of the malignant endometrial implant and the third the transformation of one of the latter into carcinoma. The histological structure of the glands shown and is similar. In the carcinoma the epithelial cells are growing rapidly, their nuclei are larger, mitotic figures are present, and the cells have lost their normal arrangement and have invaded the surrounding tissue.

36) The distribution of the implants also suggests that they primarily escaped through the tubes (Fig 30). They were especially numerous on the surface of both of the ovaries more on the lateral surfaces, (Fig 3), on the fundus of the uterus, terminal portion of the ileum (Fig 3), on the sigmoid, and in the omentum and the cul-de-sac, namely the structures most easily reached by material escaping through the tubes.

CASE 3. Implantation carcinoma of the posterior surface of the uterus, both broad ligaments, cul-de-sac, sigmoid, omentum, and left ovary associated with adenocarcinoma of the body of the uterus and possibly an endometrial sarcoma.

A H No 87799. The patient, age 63, complained of abdominal pain and uterine bleeding. She was a widow who had had one child, 3 years ago. The menopause occurred at the age of 55. She had had uterine bleeding for 5 years but it had never been profuse. Abdominal palpation was negative, except for a sense of resistance just above the right Poupart ligament. Pelvic examination showed that the uterus was enlarged and in normal position. There was marked distention in the cul-de-sac and an definite mass at the right of the uterus at the pelvic brim. The tentative pre-operative diagnosis was an ovarian carcinoma of the right side, with implantation in the cul-de-sac, and also possibly an associated carcinoma of the body of the uterus. At the operation at the Albany Hospital, December 8, 1921, the omentum as found to be greatly thickened and adherent to the brim of the right side of the pelvis presenting the gross appearance of malignancy. (This had led to the pre-operative diagnosis of ovarian carcinoma.) Both ovaries were trophied, both tubes appeared normal and the uterus was slightly enlarged. Implants were found on the

posterior surface of the uterus, both broad ligaments, cul-de-sac, and sigmoid (Fig 38). The entire uterus and both tubes and ovaries were removed. The patient made a satisfactory convalescence.

The entire specimen was hardened in 10 per cent formalin. A sagittal section of the uterus (Fig 39) showed that its entire cavity was distended by a typical adenocarcinoma except for a tumor about 5 centimeters in diameter which had the gross appearance of submucous leiomyoma, but was more homogeneous and softer. Histologically the latter was very cellular without gland formation, differing somewhat from the usual solid type of adenocarcinoma and resembling more closely the endometrial sarcoma described in Case 2, but was not as typical of sarcoma as the latter. Just as in Case 1 at the junction of the solid tumor with the endometrium, the tumor cells could be seen apparently arising from or replacing the stromal cells of the latter so that it was difficult to determine the exact line of demarcation between them (Fig 41). The implants were all alike and of the glandular type. Epithelial cells, when present on the surface of the implants, resembled normal uterine epithelium and the glands in the superficial portions of the majority of the implants did not in any way suggest malignancy but were identical in their histological structure with the glands found in benign endometrial implants (Fig 44). The glands in the deeper portions of the implants gradually assumed the typical histological structure of malignancy (Fig 45). The histological study of the implants presents a very interesting problem. Were there benign endometrial implants before the cancer of the uterus developed and was there a simultaneous development of malignancy both in the mucosa of the uterus and in these implants? If





Fig. 46. Case 4. Bilateral ovarian carcinoma associated with an adenocarcinoma of the body of the uterus, all three tumors having the same histological structure. Posterior view of the uterus, tubes and ovaries ( $\times 34$ ). Were the ovarian tumors derived from the uterine tumor from bits of malignant tissue escaping through the tubes and becoming reimplanted on the surface of the ovaries, just as benign endometrial implantations on the ovary may arise and develop into benign endometrial cysts? The latter are often bilateral and the ovaries may be the only structures in the pelvis involved. The tubes of this specimen are patent.

these implants arose from the escape of epithelium from the adenocarcinoma of the uterus we must infer that at first they assumed the histological structure of normal uterine glands and that in some way they displayed their true character only after they had invaded the deeper tissues. Dr. Jacobson suggested that both normal and malignant uterine epithelium may have escaped simultaneously through the tubes, but the age of the patient was against the probability of normal endometrium becoming implanted. Sections were made of both tubes, and while small amount of blood was found in each, bits of definite cancerous epithelium were not seen. A small malignant implant was found on the surface of the left ovary. The study of other cases of benign and malignant implants and the distribution of the implants in this case leads me to believe that the latter primarily arose from epithelium escaping from the uterine cavity through the tubes.

**CASE 4. Bilateral ovarian carcinomas with ascites and early (microscopic) peritoneal implants associated with adenocarcinoma of body of uterus, all three tumors having the same histologic structure.**

A. H. N. 88548. The patient, age 63, complained of abdominal distention. She had had three children, the youngest being 3 years of age. The menopause occurred at the age of 54 and there had not been any bleeding from the uterus since that time, until recently when serous blood tinged discharge had been present. The abdominal distention was first noticed 4 weeks before I saw her and had increased rapidly. The abdomen was greatly distended and presented the physical signs of ascites. Pelvic examination showed that the uterus was retroflexed and that there was a tumor on

each side about the size of one fist. Implantation was not detected in the cul-de-sac. The pre-operative diagnosis was bilateral malignant ovarian cysts with ascites. At the operation at the Albany Hospital, January 20, 1923, the abdominal cavity was found filled with fluid. The peritoneum and omentum were markedly injected, but without the characteristic gross appearance of implantation carcinoma. Both tubes and ovaries and the entire uterus were removed (Fig. 46). A supravaginal hysterectomy was first done in order to disturb the ovarian tumors as little as possible and the cervix was removed afterward. The patient made satisfactory convalescence.

A sagittal section of the uterus (Fig. 48) shows papillary growth arising from the endometrium of the anterior wall and distending the uterine cavity. Histologically it is one of papillary adenocarcinoma, arising from the uterine mucosa (Fig. 50). The gross appearance of the ovarian tumors is shown in Figures 46 and 47. The histological structure of the ovaries and uterine tumors is identical (Fig. 49). Histologically the peritoneum was injected and in places granulation tissue had developed with an occasional small malignant implant imbedded in it. The latter are probably derived from the ovarian tumors as the ascitic fluid contained clumps of epithelial cells. Certain questions naturally arise.

Was there simultaneous development of cancer in both ovaries and the uterus, and if so did the malignancy in the uterus arise in endometrial tissue resulting from benign endometrial implants which had remained benign for many years?

Was the uterine carcinoma secondary to the ovarian, from malignant epithelial cells carried



Fig. 47. Case 4. Cross section of one of the ovarian tumors (natural size) showing the gross appearance of the growth (Figs. 48 and 49).

through the tubes to the uterine cavity and becoming implanted on the uterine mucosa?

3. Were the ovarian tumors secondary to the tumor being derived from epithelium escaping through the tubes and becoming implanted on the surface of the ovaries just as benign endometrial implants on the ovaries arise and develop into endometrial cysts. The latter are often bilateral and the ovaries may be the principal or the only structures in the pelvis involved. Both tubes were patent and small amount of blood with clumps of epithelium was found in the lumen of one of them. I was unable to convince myself that this epithelium was malignant. The uterine tumor is of type found in adenocarcinoma of the body of the uterus and arose directly from the uterine mucosa and the surface epithelium of the non-malignant endometrium was continuous with that of the papillary adenocarcinoma (Fig. 50).

I believe that these four cases demonstrate (a) that malignant endometrial tissue may at times escape from the uterine cavity out through the tubes into the peritoneal cavity and give rise to peritoneal and ovarian implants and (b) that the latter may develop



Fig. 48. Case 4. Sagittal section of the uterus (natural size) showing the gross appearance of the uterine tumor. It is a papillary adenocarcinoma (Figs. 49 and 50).

into malignant ovarian tumors just as normal endometrial tissue escapes through the tubes, causing endometrial growths on the surface of the peritoneum and ovaries. The latter may also develop into benign endometrial cysts.

#### MANIPULATION OF THE UTERUS BEFORE AND DURING OPERATION AS A CAUSE OF THE DISSEMINATION OF CANCER OF THE BODY OF THE UTERUS THROUGH THE TUBES INTO THE PERITONEAL CAVITY

As normal uterine epithelium cast off by menstruation into the uterine cavity may at times escape through the tubes into the peritoneal cavity and give rise to endometrial growths and as cells from malignant tumors of the endometrium may also escape through the tubes and cause malignant implantation, we would expect that the manipulation of the uterus during pelvic examinations, treatments and operations would at times be responsible for the origin of these. I believe that this is true.

It is a common procedure in gynecological operations for the relief of retroflexion and



Fig. 49. Case 4. Two photomicrographs (X60) from sections of the ovaries and uterine tumors shown in Figures 47 and 48. The upper half is from the ovary and the lower half from the uterus. The histological details of the two are identical. Did the ovarian tumors arise as benign endometrial implants which are of common occurrence in the ovaries, or from the implantation of bits of malignant tissue escaping from the uterine tumor through the tubes, as often occurs in benign endometrial implantation? I believe the latter. (See Fig. 50.)

descensus of the uterus first to curette the uterus, repair the pelvic floor if that is needed and then open the abdominal cavity and do one of the many operations for the correction of uterine displacement. After curetting the uterus the operator often replaces it, and palpates the body of the uterus between the finger or fingers in the vagina and the hand on the abdomen. If the tubes are patent some of the blood in the uterine cavity holding in suspension fragments of endometrium scraped away by the curettage will at times be forced into the tubes (Fig. 51). The uterus may be compared to a rubber syringe with two nozzles (the two tubes). The more thorough the curettage and the greater the manipulation, the greater the chance for material in the uterine cavity to gain access to the peritoneal cavity. If the fimbriated ends of the tubes are carefully examined, on opening the abdominal cavity after curettage,



Fig. 50. Case 4. Photomicrograph (X49) of section of the uterine tumor at its junction with the normal endometrium. The latter (to the right) is atrophic and its surface epithelium is continuous with that of the tumor and the latter is definitely arising from the uterine mucosa. Bits of malignant tissue broken off from the tumor might easily escape through the tubes and become implanted on the surface of the ovary, just as menstrual blood carrying epithelium may escape through the tubes and cause benign endometrial implantations on the ovaries. These may develop into benign endometrial cysts which are often bilateral.

blood may sometimes be seen escaping from the fimbriated opening of one or both tubes. If the body of the uterus is grasped between the thumb and fingers of one hand and the tubes gently stripped from the uterus toward the fimbriated end, more blood may sometimes be expressed from the latter. I made these observations in 14 cases in which I had curetted the uterus prior to an abdominal operation for the correction of uterine displacement, and found that in 8 cases blood had been forced into one or both tubes. In two instances, bubbles of air also appeared on gently stripping the tubes. The blood was collected by means of a medicine dropper in several instances, smears were made and stained, and in them epithelial cells were found by Dr. Lyle A. Sutton. In 4 cases in which I wished to prevent further conception, the tubes were first cut close to the uterus and then the rubber syringe-like action of the uterus was well demonstrated in 3 of these for on squeezing the fundus of the uterus, blood was forced through the lumen of severed tube (Fig. 52).

I do not know to what extent bimanual examination, curettage, the Rubin test for patency of the tubes, and operative manipu-

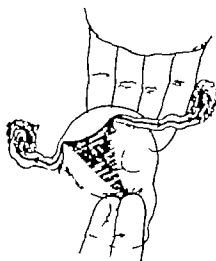


Fig 5 (X36) In the bimanual palpation of the uterus the pressure exerted by the hand on the abdomen and the fingers in the vagina often closes the cervical canal and may force any fluid contents of the uterine cavity out through the tubes, if the latter are patent. The tubes may be aspirated with a rubber syringe with two nozzles—the two tubes. If the contents of the tubes carry bacteria, peritonitis may result if they harbor cancer cells set free in the uterine cavity by manipulation or curettage. Implantation of cancer may occur in the pelvis. In 4 patients in whom curettage of the uterus and bimanual palpation of the same preceded an abdominal operation for uterine displacement, blood was found escaping from the fimbriated ends of one or both tubes in eight. (See text.)

lation of the uterus, are responsible for the origin of benign endometrial implantation. A more important problem presents itself and that is the dissemination of cancer of the body of the uterus through the tubes during pelvic examination, curettage, the application of radium and hysterectomy. We are too well satisfied with the results of the operative treatment of cancer of the body of the uterus because the percentage of cures is low compared with the operative treatment of cancer of the uterine cervix. If bimanual examination of the bleeding uterus, curettage and operative manipulation will at times, force blood containing in suspension bits of normal endometrial tissue through the tubes these same procedures will also at times force blood containing cancer cells through the tubes into the peritoneal cavity if the patient has cancer of the uterine body and the tubes are patent. Should this epithelium fall on suitable soil and grow the patient will die from

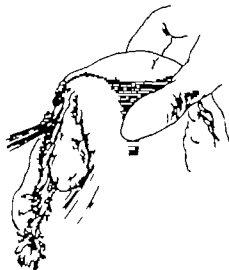


Fig 5 (X36) In 4 patients in whom curettage of the uterus preceded the abdominal operation and the uterine ends of the tubes were cut in order to prevent further conception, blood could be forced from the lumen of the severed ends of the tubes in three of three, by squeezing the body of the uterus. These observations demonstrate the possible danger of bimanual palpation, curettage and the manipulation of the uterus during hysterectomy, in forcing the contents of the uterine cavity out through the tubes, and therefore the importance of ligating the fimbriated ends of the tubes in hysterectomy for cancer of the body of the uterus. (See Figs 54, 55 and 56.)

cancer even though the primary growth in the uterus is subsequently entirely destroyed by radium, or the uterus is removed. A preliminary diagnostic curettage is usually done before the introduction of the radium, and the capsule containing the radium would act as a piston in a piston syringe forcing the contents of the uterine cavity into the tubes (Fig 53). The question naturally arises, why does this not occur in every instance in which the tubes are patent? In the majority of the cases of cancer of the body of the uterus, the patient is fortunately past the menopause when the tubes are atrophic, with a consequent diminution in the caliber of their lumen. In other cases the growth may be so extensive as to block the opening of the tubes into the uterus. Again, the epithelium escaping through the tubes may not give rise to implantation in every instance i.e. conditions may not be favorable for its growth.

In the year 1904, while on Dr. Howard A. Kelly's staff at the Johns Hopkins Hospital,

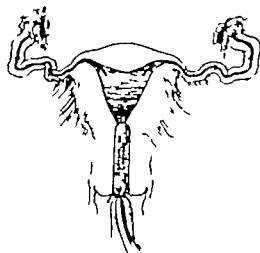


Fig. 53 (X 5). I introducing the capsule containing radium into the uterine cavity through the cervix; the uterus is converted into a piston syringe—the capsule acting like a piston might force the fluid content of the uterine cavity out through the tubes (the two nozzles of the syringe) if the latter were patent and should implantation of cancer occur in the pelvis the patient could die from cancer even though the primary growth in the uterus was destroyed by the radium or the uterus later removed by operation.

I designed a right angle clamp for clamping across the vagina below the cervix in abdominal hysterectomy for cancer of the uterine cervix. This clamp was but a modification of the clamp described by Wertheim for this purpose. Since that time I have used this clamp as a routine procedure in hysterectomy for both cancer of the cervix and body of the uterus. After clamping across the vagina below the cervix a vaginal douche is given and the vagina is wiped dry with bits of gauze before cutting across the vagina below the clamp and removing the uterus. This procedure is followed for two purposes: to prevent the infection of the field of operation with bacteria and to prevent the possible implantation of bits of cancer in the pelvis.

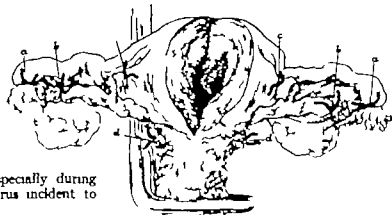
My reaction toward the diagnostic curettage in suspected cancer of the body of the uterus has undergone a change in the last 10 years. This was brought about chiefly by my experience with 2 patients. The first occurred in 1912. A "recurrence" of cancer followed soon after a hysterectomy for early cancer of the body of the uterus in which there had been

a preliminary diagnostic curettage. The following year I found blood in the cul-de-sac of a patient who had also had a preliminary curettage. I thought that possibly I had perforated the uterine wall with the curette but was unable to find any evidence of this. It did not occur to me to examine the fallopian tubes. The patient subsequently died from a recurrence of the cancer. Since that time I have used the diagnostic curettage in patients with uterine bleeding only in those in whom I did not suspect cancer or when I considered the patient a poor operative risk. In all other cases of suspected cancer of the body of the uterus I remove the uterus without a preliminary curettage. I have found that the diagnosis of cancer of the body of the uterus can be made with reasonable certainty in a large percentage of patients with this condition without resorting to curettage.

In March 1922 I found blood and clumps of epithelial cells in the lumen of a tube from a specimen of cancer of the body of the uterus. I had done a preliminary diagnostic curettage as I considered the patient a poor operative risk. In November of the same year Dr. Jacobson, knowing my interest in the escape of the contents of the uterine cavity into the tubes, called my attention to a section from one of my cases of cancer of the body of the uterus, in which a clump of epithelial cells was present in the lumen of one of the tubes, the epithelial cells being of the same histological structure as those of the adenocarcinoma of the uterus. The patient had had a diagnostic curettage in another hospital a week before I had operated on her.

Schiller (11) has reported a case of free cancer particles in the tube of a specimen of primary carcinoma of the body of the uterus. He states that his case was similar to one reported by von Franke. He believes that the displacement of the tumor particles into the tube can be explained by assuming that these particles were pressed into the tube by contractions of the uterus, and that the normal contractions of the tube and the action of its ciliated epithelium were not strong enough to overcome this in action. In this paper he also discusses the origin of peritoneal and ovarian implantations from this source. I believe that

there are often more important factors in causing this displacement, as, a damming back of blood in the uterine cavity and the forcing of blood from the uterine cavity into the tubes in bimanual palpation by the curette in the manipulation of the uterus during the curettage. If that has been done, and especially during the manipulation of the uterus incident to hysterectomy.



The finding of free particles of cancer in the lumen of the tube in two specimens of cancer of the body of the uterus operated upon by me together with the knowledge that benign and malignant endometrial implants arise from epithelium escaping through the tubes into the peritoneal cavity caused me to adopt what I consider a very important procedure in preventing the dissemination of cancer of the body of the uterus during hysterectomy. This is the *ligation of the fimbriated ends of both fallopian tubes before attempting to remove the uterus*. This is of scientific value because it prevents material present in the lumen of the tubes before operation, or forced into them during it, from being squeezed out through the fimbriated extremity by operative manipulation and thus lost for microscopic study. It is of humanitarian importance in preventing the possible implantation of cancer in the pelvis and the subsequent death of the patient from the so-called recurrence of cancer which the surgeon had unintentionally caused. I have carefully examined the tubes in four specimens of cancer of the body of the uterus in which this procedure was employed and found blood and particles of cancer in two. For the findings in one of these see Figures 55 and 56.

The histological study of the myometrium in specimens of cancer of the body of the uterus demonstrates that at times cancer may be found penetrating and projecting into the venous sinuses of the uterine wall (Fig. 57). The manipulation of the uterus in bimanual examination and in operative procedures is attended with the danger of break-

ing off particles of these projections and permitting them to be carried into the uterine and ovarian veins from which they may be carried to the lungs or escape into the peritoneal cavity during the operation unless the uterine ends of the veins are occluded by ligature or clamp. Clamps attached to the uterine end of the ovarian and uterine veins are likely to slip so I believe that it is safer in hysterectomy for cancer of the body of the uterus, to ligate doubly the ovarian and uterine vessels, with the least possible manipulation of the uterus and cut between the ligatures so that blood from the uterus can not escape from these severed vessels into the peritoneal cavity.

The various steps to prevent the implantation of particles of cancer in hysterectomy for cancer of the body of the uterus are indicated in Figure 54.

Fig. 54 Drawing (X35) of the uterus, tubes and ovaries, showing the methods used to prevent particles of cancer from escaping from the uterus into the pelvis during hysterectomy. The patient (A. H. N. 88958) age 55 complained of uterine bleeding of months duration, but had not had diagnostic curettage. The fimbriated ends of both tubes are ligated to prevent any particles of cancer present in the lumen of the tubes before the operation, or forced into it during the latter from escaping into the peritoneal cavity during the manipulations incident to hysterectomy (Fig. 55). The ovarian and uterine vessels and round ligaments are ligated doubly and cut between the ligatures, to prevent any particles of cancer protruding to the venous sinuses of the uterine wall, or present in the lumen of the veins, from escaping into the pelvis during the operation (Figs. 57 and 58). The vagina was clamped below the cervix and thoroughly cleansed before severing it and removing the uterus, thus preventing any of the material in the uterine cavity (Fig. 56) from escaping into the field of operation.

The various steps to prevent the implantation of particles of cancer in hysterectomy for cancer of the body of the uterus are indicated in Figure 54.

## CONCLUSIONS

The implantation of benign endometrial tissue upon the surface of the various structures in the pelvis is of common occurrence. It was observed by me in 64 of 296 abdominal operations for pelvic conditions in 1 year.

The implants, wherever situated may invade the underlying tissue on which they develop, spread over the surface of the same, or invade other structures in contact with them. In their reaction to menstruation, epithelium may be cast off and give rise to other or secondary implants.

The peritoneal implants are usually small, slow growing, and insignificant, but occasionally spread and become invasive.

The ovarian implants are frequently much more active than the peritoneal, suggesting that the ovary is generally their most "fertile

soil. They often develop into superficial or deep menstruating ovarian cysts. The superficial cysts are small, a few millimeters in diameter while the deeper ones may reach a much larger size, several centimeters in diameter. Whether small or large, these endometrial cysts or hematomata often perforate, and some of their contents, carrying epithelium cast off by menstruation, escapes into the peritoneal cavity. Other or secondary implants apparently arise as a result of these perforations. The ovary may be considered an incubator hot bed or redistributing focus, in the origin of these secondary growths.

The evidence that these implants may primarily arise from epithelium with at times, bits of stroma derived from the uterine mucosa (possibly occasionally from the tubal mucosa) as a result of a back flow of menstrual blood

## PLATE II

Fig. 27 (Case 1) Left tube and ovary (natural size). The lower fimbriae of the tube are adherent to the surface of the broad ligament below the ovary. The fimbriae just below the opening of the tube are thickened and in solid by cancer extending out through its opening. A ligature had been placed about the tube to prevent any material or its juices from escaping into the pelvis during the operation. Ovarian or peritoneal implants of cancer were not found.

Fig. 31. (Case 2) Left tube and ovary (natural size). The ovary is turned upward, exposing its lateral surface which is studded with malignant endometrial implants in all stages of development (more numerous on the lateral surface of the ovaries, as occurs in benign endometrial implantation). Implants are also present on the surface of the broad ligament.

Fig. 3. (Case 3) A portion of the terminal loop of the uterus (natural size) on which the malignant endometrial implants are especially numerous. Compare with Figure 4, showing benign endometrial implants also on the surface of the terminal loop of the uterus. The reaction of the benign implants to menstruation enables them to be readily recognized and distinguished from the malignant ones.

Fig. 42. Epiploic appendage of the sigmoid with benign implantation endometrial invasion (natural size) from the same case as the illustrations shown in Figures 5 and 6. The gross appearance of the appendage with the pigmentation due to menstruation in the endometrial tissue is characteristic of this lesion. Compare with Figure 43 (see also Figs. 44 and 45).

Fig. 43. Epiploic appendage of the sigmoid with malignant implantation endometrial invasion (natural size). Case 3. The gross appearance of the appendage is characteristic of this lesion and differs from that shown in Figure 4 (see also Figs. 44 and 45).

Fig. 55. Colored photomicrograph ( $\times 50$ ) of a portion of a cross section of one of the tubes shown in Fig. 54. The lumen was filled with blood, leucocytes, and an occasional clump of epithelial cells which are similar to the clumps of cancer cells found in the debris in the uterine cavity (Fig. 56). One of these clumps is shown sur-

rounded by blood with greater proportion of leucocytes than as present in normal blood. At the left is the tip of villus of the tubal mucosa. I believe that the bloody contents of the tube containing clumps of malignant cells escaped from the uterine cavity into the tubes before the operation, or were forced into the latter during surgical manipulations. The ligature about the fimbriated ends of the tubes as of scientific value in preventing the loss for microscopic study of this material and was also of known value importance as an aid in preventing the implantation of cancer in the pelvis and the subsequent death of the patient from so-called recurrence of cancer.

Fig. 56. Colored photomicrograph ( $\times 125$ ) of a section through the surface of the cancer of the body of the uterus (Fig. 54). The debris is histologically similar to that found in the tubes and indicates the origin of the latter. Clinical and pathological studies demonstrate that particles of cancer escaping into the pelvis may cause implantation of cancer. Hence the importance of ligating the tubes and clamping across the vagina below the cervix before removing the uterus, as shown in Figure 54.

Fig. 57. Colored photomicrograph ( $\times 60$ ) of a section of a portion of the uterine wall (Fig. 54). Cancer has invaded the lumen of uterine vessels. Manipulation of the uterus before or during the operation might easily dislodge such tissue and permit fragments of it to escape into the uterine or ovarian cavity. It is important to examine greatly patients in whom we suspect cancer of the body of the uterus. It is likewise important in hysterectomy to ligate doubly the ovaries and uterine vessels and to cut between the ligatures with the least possible manipulation of the uterus as indicated in Figure 54.

Fig. 58. Colored photomicrograph ( $\times 60$ ) of a portion of a section of the right tube of the specimen shown in Figure 56. Cancer is present in the debris in the outer portion of the wall of the tube, the opposite tube from the one containing cancer in its lumen (Figs. 7, 28 and 30). This section emphasizes the importance of avoiding vigorous bimanual examination and curettage and likewise the necessity of controlling the uterine vessels of the uterus in hysterectomy.



Fig. 47



Fig. 48



Fig. 49



Fig. 50



Fig. 51



Fig. 52



Fig. 53



Fig. 54



Fig. 55

PLATE IV —(See legends on opposite page.)

*Benign and Malignant Endometrial Implants in the Peritoneal Cavity—John A. Simpson*





through the tubes, is as conclusive as that of the origin of any pathological condition (see text of article)

These implants and the endometrial structures arising from them react to menstruation, pregnancy and the menopause (natural or surgical) in the same way as does the mucosa lining the uterine cavity. They are thus governed by the same natural laws as the latter and we would infer that they are liable to similar pathological changes. I am convinced that malignant ovarian tumors may arise in these benign endometrial structures in the ovary (this I have observed) and also in the benign peritoneal implants. Future studies will determine to what extent the implantation of uterine and tubal tissue on the ovary is responsible for the development of ovarian tumors other than typical menstruating endometrial cysts.

Bits of malignant tissue from malignant endometrial tumors also at times escape from the uterine cavity through the tubes and give rise to peritoneal and ovarian implants. The latter may develop into malignant ovarian tumors (see text of article).

Clinical observations (see text of article) demonstrate that curettage and manipulation of the uterus may force blood containing bits of endometrial tissue out through the tubes into the peritoneal cavity. The uterus may be compared to a syringe with two nozzles, the tubes, sometimes acting as a rubber syringe and at other times as a piston syringe (Figs 51 and 53). Should the tissues escaping into the peritoneal cavity be malignant, the patient may die from a so-called recurrence of cancer even though the primary growth be subsequently destroyed by radium or the uterus be removed. Particles of cancer were found lying free in the lumen of the tube in four of seven specimens of cancer of the body of the uterus removed by me this last year. Three of these 4 patients had had a diagnostic curettage (only one done by me).

Bearing in mind the readiness with which endometrial tissue may become implanted and grow in the tissues of the pelvis, and the avenues and the means by which it may escape from the uterus it is of the greatest import-

ance to attempt to prevent this implantation in the diagnosis and the treatment of cancer of the body of the uterus.

It seems advisable to lay down the following rules in the treatment of this disease:

1. A patient in whom cancer of the body of the uterus is suspected should be examined with great care and gentleness.
2. The diagnostic curettage should be employed only in doubtful cases or poor operative risks, and if used should be done very gently.
3. Radium should not be used as the insertion of the capsule containing the radium acts as the plunger of a piston syringe forcing contents of the uterine cavity into the tubes.
4. Abdominal hysterectomy with the least possible manipulation of the uterus, and the closure of the channels through which material may escape from the uterus into the field of operation, offer the best chance for a permanent cure. The fimbriated ends of the fallopian tubes should be first ligated, the ovarian vessels, round ligaments, and uterine vessels should be doubly ligated, cutting between the ligatures the vagina should be clamped below the cervix and carefully cleansed before severing the vagina below the clamp and removing the uterus.

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CO-ORDINATION OF HUMAN VEGETATIVE FUNCTIONS<sup>1</sup>

By WILLIAM J. MAYO, M.D. F.A.C.S. ROCHESTER, MINN.

THE era of surgery based on gross pathology is passing. Investigations of a physiological nature are enabling the detection of pathological changes in tissues in the early transitional periods. This fact leads to the hope that many diseases can be recognized at such an early stage of deviation from the normal that they may be prevented from assuming serious aspects. Because of this hope the work of the physiologist is being followed with the greatest interest by the surgeon, and deductions are being made which effect the whole surgical concept. Cathart and Benedict estimate that only 25 per cent of the energy produced in the body can be expended by the tissues under the control of the will. 75 per cent being used by the vegetative functions of the body of which we are unconscious. In order to obtain a general view of the subject I have reviewed briefly as related to those functions of which we are conscious (25 per cent) some facts and near facts which underlie the mechanism of co-ordination and control of the vegetative functions (75 per cent). He that does not go beyond the facts," said Huxley "will seldom get as far as the facts."

## NON-STRATED MUSCLE

Non-striated muscle is one of the most interesting and important tissues of the body not only because it is the tissue earliest concerned in motion, but because it has been endowed with a curious type of self-control possessed by few, perhaps by no other tissues in the body. Non-striated muscle originates its own action and within the limits of the influences which necessitate the action it is self-sufficient. The production of power to carry on the vegetative functions lies in the non-striated muscular system and the ultimate source of this power is molecular and colloidal energy released through enzyme action which is as marvellous as the energy in radium. It has been demonstrated experimentally that if the thoracic and abdom-

inal viscera are disconnected completely from all nerve connections, and the circulation and respiration are continued artificially the liver will secrete bile, the kidneys urine, and the digestive functions will be continued suggesting that physical laws play the pre-dominant part in the functions of organs. The modern biochemical theory, for example in relation to the action of enzymes, assumes that the enzymes are controlled by physical and chemical laws, which possibly represent a rapid colloidal bombardment of the attacked material by its peculiar type of energy.

Krogh, whose experimental studies on the blood capillaries gave him the Nobel prize in physiology in 1920, has added greatly to our knowledge of the mechanism of body nutrition. It had been believed that the capillaries were endothelial channels, but Krogh confirmed the observation that even the finest capillaries contain smooth muscle fibres through the walls of which oxygen and crystalloids, such as glucose sugar and the amino-acids, supply the body cells by diffusion. Crystalloids are in a molecular state and penetrate the capillary walls everywhere, because the pressure inside the arterial capillaries is greater than that in the tissue spaces, and greater in the tissue spaces than in the venous capillaries which receive the waste products of oxidation but unless there is great dilatation of the capillaries which increases their permeability to larger bodies the colloids do not penetrate the capillary walls, except in the liver and gastro-intestinal tract. The colloids of the blood are made up of different sized molecules hence there is variation in the permeability of the capillary wall to different colloids. The osmotic pressure, the state of dilatation of capillaries, and the size of the colloid molecule are the controlling factors. Increased work of any organ of the body causes dilatation of the capillaries. This power of dilatation and contraction lies in the non-striated muscle coat. Variations in caliber of the capillaries may be brought

<sup>1</sup>Read before the Clinical Congress of the American College of Surgeons, Chicago, October 27-28, 1923.

about by the many influences which affect life processes and are to a great extent in dependent of nerve control. For instance, the effect of cold on the skin is to produce contraction of the arterial capillaries, resulting in blanching, which is followed by blueness due to dilatation and stasis of the venous capillaries distended with non-oxygenated blood. Krogh's experiments show that histamine causes enormous dilatation of the venous capillaries, resulting in more or less complete stasis of the red corpuscles and escape of the colloids of the blood plasma into the tissues. The animal under experimentation bleeds to death in its own tissues so to speak, reproducing the picture of shock, which suggested to Krogh that pituitrin, an agent that causes dilatation of the arterial capillaries, might be of use in this condition.

The self-sufficiency of primitive muscle can be illustrated in many ways. A small piece of the intestinal wall, placed in Locke's solution will contract for hours. The intestines have two beats: one called peristalsis which occurs once or twice to the minute and the second beat, which Mall called the heart of the portal circulation, occurring eighteen to twenty times to the minute. The slow contraction of the spleen at the end of the digestive period is the result of non-striated muscle tissue together with a peculiarly unique arrangement of the elastic fibers of the capsule and trabeculae of the spleen. Again differential diagnosis between pregnancy and tumors in the lower abdomen can be made by means of the rhythmic contractions of the uterine body which can be felt with the hand. While the heart is composed of striated muscle it is a most primitive type. The beat of the heart originates in the base of the organ. The impulses are collected in the sino-aortic node a curious form of muscle tissue and are sent through the muscle band of His to time the ventricular beat.

Hyperplasia as well as hypertrophy is an extraordinary attribute of the non-striated muscle and in conjunction with its auto-controlled rhythmic action is responsible for the production of power in the work of fundamental functions. Increased work, backed by increased power of growth is illustrated

in the gastro-intestinal tract by the familiar examples of enormously increased musculature which works apparently without fatigue, as in the gastric musculature in cases of pyloric obstruction, and also in the intestinal wall in cases of intestinal obstructions. In this power of rapid growth lies the cause of the leiomyomata of which the so-called uterine fibroids are the most common.

#### THE EIGHT NEUROMUSCULAR NODES

In the process of digestion the food passing into the oesophagus is beyond the control of the will. Impulses originating from the mechanical impact of the food in the oesophagus cause relaxation of the cardiogastric sphincter permitting food to pass into the stomach. After the food enters the stomach the rate and timing of its passage, as pointed out by Hurst are due to reflexes which start in the transverse colon progressively relax the ileocolic and pyloric sphincters, and start the peristaltic waves. The manner in which this is accomplished is shown by Keith who discovered the nodal system and more or less accurately located eight neuromuscular nodes which can be compared with the sino-aortic node of the heart, and may be said to act on the intestinal tract as pace makers as does the block system on a railway. The first node at the beginning of the oesophagus governs the oesophageal reflex. Impulses are carried from here to the second node which controls the cardia. Failure of this node to relax the cardiac orifice causes cardiospasm as a result of which many persons have died unnecessarily of starvation because the obstruction was believed to be malignant. The third node is at the termination of the primitive foregut near the common duct the site where Ochsner has pointed out evidences of the remnant of a rudimentary muscle. This explains the occasional birth of a child with complete stricture at this point. Disturbances of this node produce the condition known as pylorospasm.

The illuminating character of embryology in its illustration of clinical problems is found in the frequency of ulcer of the first portion of the duodenum and forces on us the realization that fundamentally the first portion of the

duodenum while it has the form of the intestine, biologically is part of the stomach having its origin in the primitive foregut and receiving its blood supply from the coeliac axis. The fourth node demonstrated by Keith is near the duodenojejunal angle, and is related to those not infrequent cases of gastromesenteric ileus which we have only recently learned may assume a chronic and relapsing form instead of the acute and sometimes fatal vicious circle. The fifth node is at the ileocolic juncture and is concerned in the intestinal stasis of which Lane has written so interestingly. The sixth node is located at the middle of the transverse colon which marks the termination of the primitive midgut. Here again embryology explains why absorption takes place in the right half of the colon which like the small intestine is supplied by the superior mesenteric vessel, and not in the left half of the colon which is supplied by the inferior mesenteric artery and by antiperistaltic action keeps the food in the right half for absorption. The cecum ascending colon, and the right half of the transverse colon are fundamentally part of the small intestine and in the fetus have villi, the counterpart of those continued in the ileum and jejunum. After birth there is a change in form but not in function.

We know that the fluids which float the food products through the small intestines are largely absorbed in the head of the colon. Reasoning from the analogy of the huge cecum and ascending colon of the herbivorous animal it may be assumed that the proximal half of the colon was essentially intended for carbohydrate fermentation. Possibly some of the difficulties which Lane believes are the results of bands of adhesions may be due to increase in flesh consumption, the end products of which undergo putrefaction resulting in the development of poisons which are thrown into the head of the colon converting it into a cesspool. The seventh node is at the rectosigmoid juncture, and failure of function at this point has to do with giant colon, or Hirschsprung's disease. The eighth node is concerned with rectal control. All these nodes are connected with the autonomic system by nerve fibers.

#### THE INTERNAL SECRETIONS

While we recognize the autocontrol of the non-striated muscle and believe that the stimulation which results in intestinal peristalsis, for example is largely mechanical this power of originating muscular actions is closely related to and influenced greatly by another form of more generalized co-ordination which is best understood under the general title of internal secretions. Vincent one of the most able of the investigators in this field very justly says that the use of the terms *endocrines* and *endocrinology* is camouflage of ignorance as though giving a less expressive name derived from a dead language in some mysterious way helps to elucidate a subject as yet little understood, and he comments, as has Cushing on the extraordinary vogue which theorists with few facts and great imagination have given the subject. Starling asserts that the internal secretions antedate all forms of nervous systems. It is interesting to note that the alliance between the sympathetic nervous system and the glands of internal secretion is relatively close. All important glands of internal secretion which take part in co-ordinated control are closely associated with the sympathetic system for example, the pituitary in which the posterior lobe is closely related in structure to this system. The adrenals exhibit the same peculiarity. One might say that the chromaffin cells of the adrenal and other ganglions are, in reality nerve cells of a type which suggests that in their inception they are associated with an entirely different kind of nervous system from any that now exists in man, and later become incorporated with the sympathetic nervous system. Certain important glands of internal secretions—the testicle and the pancreas have both internal and external secretions. The testicle has besides the secretion containing spermatozoa the secretions of the interstitial cells which control sex characteristics. The pancreas is another example of glands having external and internal secretions, in relation to digestion on the one hand and the effect of the islands of Langerhans on the metabolism of sugar on the other. The thyroid in the King scorpion is associated in function with reproduction and its connection

with puberty in the human being is evidenced by the thyroid enlargement in girls. There have been found types of lower life in which the thyroid functions with digestion. The foramen cæcum at the base of the tongue in a man marks the site where this secretion was, at one evolutionary period discharged into the intestinal tract. The thyroid finally became the gland which controls the output of energy in man.

#### THE AUTONOMIC NERVOUS SYSTEM

No study of the co-ordinating power of the non-striated muscle and the internal secretions would be complete without an understanding of the sympathetic nervous system as represented by the great sympathetic ganglions of the thorax and the abdomen. We are indebted to Gaskell for the most illuminating researches in this field. He pointed out that certain small-calibered medullated nerves pass from the anterior horns of the spinal cord to the great sympathetic ganglions and that this communication is direct from the cord to the ganglions, with the single exception of the adrenals, through which certain nerves pass en route to the ganglions, connecting the sympathetic system with the chromaffin cells in the adrenals. From the great sympathetic ganglions, small non-medullated nerves pass to all parts of the body usually along the blood vessels, to control the production of instantaneous and widespread actions. In the emotions of anger and fear Cannon corroborated the finding which shows that these fibers release the sugar reserves of the liver into the blood stream, and put the body instantly in a condition for defense. The gastro-intestinal digestion stops and the movements of the non-striated muscles are held in abeyance. The heart action is increased to withstand the shock of physical combat the pupils of the eyes dilate to permit wider vision. The skeletal muscles simultaneously are made ready for action under the control of the central nervous system. When the necessity for these defense manifestations has passed, the parasympathetic nerves described by Gaskell and Langley restore the normal condition. The most important of these parasympathetic nerves are the vagus,

a small-calibered medullated cranial nerve which reduces action of the heart and respiration and sets in motion the gastro-intestinal tract, and the pelvic nerve which permits emptying of the bladder and rectum that has been temporarily in abeyance. The parasympathetic nerves are peculiar in that they have ganglion and nodal cells at their termination for instance in the non-striated muscle of the intestinal wall as Auerbach's and Meissner's plexuses. Carlson, the eminent physiologist says that while some important facts are known the exact relationship of the autonomic nerve fibers in a given nervous disturbance is by no means settled. He comments adversely on the use of the terms *vagotonia* and *sympatheticonia* as though they represented assured and positive instead of vague and little known conditions. Langley speaks of the combined sympathetic and parasympathetic nervous systems as the autonomic system. For the sake of better understanding of the autonomic system the internal secretions and the non-striated muscle should be included with the sympathetic and parasympathetic systems under this head.

#### THE CENTRAL NERVOUS SYSTEM AND THE VEGETATIVE FUNCTIONS

We are just beginning to awaken to the knowledge of the relation of the fundamental sciences to clinical medicine. The two oldest functions of a living body are maintenance of nutrition and reproduction, and these two functions are surrounded by many safeguards. The more ancient the heredity of any part of the body the greater its inherited resistance. For instance the testicle is the ancient reproductive organ and it has few diseases its rare tumors are usually teratomata. Contrast the testicle with the ovary in this respect. The ovary is descended from the testicle is of more recent origin and develops many kinds of tumors and other lesions. New growths of the ancient small intestine are rare as compared with those of the stomach, the large intestine, and the rectum. We can safely say that the vegetative functions being older in point of heredity are more stable and better organized than the more recently acquired central nervous system which is sub-

jected to the many emotional influences which we speak of as psychic, and which through *Gaskell's nerves* may influence unduly the autonomic control and co-ordination of the vegetative functions. In the unstable individual these functional disturbances may be so exaggerated as more or less to resemble pathological processes which are accepted by the patient and the unenlightened as true although known by the trained observer to be false. Herein lies the success of the cults and quackeries. The fundus of the stomach came into existence after the central nervous system was developed. By reason of the central nervous system man has some knowledge of what goes on in the fundus of the stomach, but little or no knowledge of what occurs in the intestinal tract until the sigmoid colon is reached, except as the information comes from the stomach. Food does not leave the stomach of its own accord. If there is interference with intestinal peristalsis, food remains in the stomach too long and there results gastric indigestion, so-called dyspepsia, recognized now as a secondary phenomenon, but formerly regarded as an indication of gastritis or disease of the stomach itself. The designation of indefinite pathological conditions by such terms as *achlorhydria*, *hyperchlorhydria* and *achylia gastrica* which in reality merely indicate symptoms is unwarranted and deplorable.

Again the progress of the food intake is greatly influenced by somatic disease. Patients with *tuberc* have had gastro-enterostomies performed or the gall bladder removed, for gastric crises. The anorexia of the hysterical state is universally recognized. Tuberculosis is often ushered in by gastric symptoms, in the useless treatment of which much precious time is lost. The masquerading dyspepsias of heart disease, pernicious anemia and chronic nephritis too often lead to loss of valuable time before correct diagnosis is made and proper treatment instituted. The dyspepsias associated with gall stones, appendicitis, and obstructed hernia are equally pertinent instances. The fundus of the stomach can be compared to a branch telephone office in which the relaying of messages to the central station, the brain, is misinterpreted. As Fin-

ney points out the relatively late development of the sigmoid is well shown in its varying length and position, and in the fact that the brain becomes more or less conscious of the sigmoidal state. Cabot remarks that mucous colitis is a disturbance of the nervous system, evidenced by the passage of quantities of mucus, leading to much complaint and frequent examination of the stools by the patient. While it has been customary in the past to regard the atonic stomach, visceral ptosis, and the position of the uterus as mechanical factors of great importance in the production of neuroses, less emphasis is placed on these conditions at the present time since a better understanding of the autonomic nervous system has been gained. The large majority of these baffling phenomena concern the fundamental functions of the maintenance of the body and reproduction (Freud's morbid theories) in relation to the central nervous system. We recognize that thought is the product of a material substance, the brain, but because we cannot see the thought we treat it as non-existent. Bodily fatigue is the result of the inability of the exhausted tissues to burn glucose sugar with sufficient rapidity and to rid themselves of the products of combustion. Rest restores the oxygen balance and food furnishes the carbonates which prevent exhaustion acidosis. Fatigue of the emotions so-called neurasthenia, concerns mentality and we know very little about it. Peabody says that neurasthenia is, to a great extent, a disease of the idle rich. We may well say that contented industry is the wellspring of human happiness. The economic status of the patient is not so directly concerned with the more common types of the so-called neuroses which are fixed tissue delusions on the general principle of "If you believe it, it is true." These unfortunate conditions are true to the patient whether or not they are true to the diagnostician.

Sherrington in his presidential address on mentality before the British Association, said that the special office of the central nervous system is to bring the bodily component parts into harmonious mechanism which will react as a unit to the world around us.

He comments on the fact that what lifts man above the beasts is mentality located in the more recent additions to the forepart of the brain and points out that nervous conditions cannot well be separated from mental conditions, although between them there is the difference between night and day.

The query arises: Are not many perhaps most of these unstable nervous conditions

so-called neuroses which are exploited by the cults and quackeries the results of an attempt of the newer part of the central nervous system to take control of previously established co-ordinating functions unrighteous attempts at control of the sympathetic ganglions, the internal secretions, and the primitive non-striated muscle by an unbalanced recent development of the forebrain?

## SEMINAL VESICULITIS AFTER PROSTATECTOMY

By MONTAGUE L. BOYD, M.D., ATLANTA, GEORGIA

**T**HERE are two points about the seminal vesiculitis occurring after prostatectomy which deserve especial attention.

1. Acute inflammation of the epididymis after prostatectomy is evidence of an infection of the seminal vesicle.

2. Such a seminal vesiculitis may be the cause of symptoms ascribed to acute or chronic cystitis, posterior urethritis, and pyelitis.

It is generally admitted that epididymitis is fairly frequently seen after prostatectomy but very little attention is given by most authors to this complication although at least one Deaver (1) calls attention to its possible seriousness. The least serious of the infectious complications, such as epididymitis may be the deciding factor in causing the death of debilitated subjects." Deaver and Wade (2) both quote McDonald as showing epididymitis occurring in about 27 per cent of the cases before and after operation and Leguen (3) speaks of 12 to 15 per cent.

The evidence from which I have drawn my conclusions that seminal vesiculitis occurs in these cases and produces symptoms which can be relieved by suitable treatment is: First in four of my prostatectomy cases epididymitis occurred in connection with a seminal vesiculitis which was demonstrated both by rectal examination and a study of the seminal vesicular secretion. Second for the past few years I have made a rectal examination and a study of the seminal secretion in every case of acute non-tubercular epididymitis and I have

found in every case the corresponding seminal vesicle infected, usually distended and containing a good deal of pus and organisms. Luys (4) is the only author I have found who mentions this. Not infrequently it was a little difficult to empty the seminal vesicle by the use of the gentle pressure which I believe should be employed in such cases but as soon as the vesicle was emptied the patients very frequently volunteered the statement that they were greatly relieved of the discomfort or pain in the lower abdomen and in the region of the inguinal canal and sometimes in the testicle and epididymis. Furthermore when the vesicle was emptied before the epididymitis became extensive the process was halted and the swelling rarely extended beyond the lower part of the epididymis. Of course exceptions occurred but they have not been sufficiently frequent to detract from my conclusion concerning the benefit to be derived from the procedure.

I am convinced then that in practically every case of epididymitis we have an accompanying infection of the seminal vesicle which in most instances should receive some treatment other than that usually employed for the epididymitis occurring after prostatectomy.

It is not my desire to exaggerate the seriousness and importance of seminal vesiculitis in these cases but rather to call attention to its fairly frequent occurrence and to try to offer a few suggestions about its prevention and cure more especially in suprapubic prostatectomy.



cases since though the complication occurs fairly frequently after perineal prostatectomy a different set of conditions exist there which require a somewhat different handling.

It is true that in some instances the seminal vesiculitis requires no attention for the epididymitis subsides, the fever disappears and the urine becomes in time free from pus and infecting organisms.

In other cases the epididymitis does not subside readily and even epididymotomy at times is necessary. In such cases, and also in some others where the epididymitis is absent or not so annoying a fairly active infection of one or both vesicles can be demonstrated.

Very naturally it is not necessary to have an inflammation of the seminal vesicles in every case of epididymitis as it need not occur where an ejaculatory duct is torn so as to separate the vasa from the seminal vesicles. But whatever the method, I feel sure that freedom from inflammation is the exception and not the rule for I have invariably found the corresponding seminal vesicle infected.

It is far more frequent, I believe, to have an infection of the seminal vesicles, even with an involvement of the ampulla of the vasa, without an accompanying epididymitis and these are the cases in which the vesiculitis is most readily overlooked, even though it gives other less evident symptoms of its existence.

#### ETIOLOGY

A case which I reported in 1920 before the Fulton County Medical Society and which will be published very soon in the *Journal of Urology* is of considerable interest in connection with this paper illustrating the possibility of the seminal vesicles becoming infected before prostatectomy. It is hardly necessary to refer most urologists to this case because nearly every one has seen the development of epididymitis in prostatic hypertrophy cases in which catheterization has become necessary and an infection has spread through the ejaculatory ducts from the posterior urethra. The pre-operative study in these cases is rarely if ever made with the idea of determining the presence or absence of a seminal vesiculitis. The investigator is usually satisfied to discover whether there are evidences of urinary

infection and whether or not the patient requires an operation, but, I dare say that if vesiculitis were looked for we would find it more frequently than is now generally believed. Proof of this, if needed, can be found in the various articles on prostatectomy in which the frequency of epididymitis occurring before operation is reported.

It is not unnatural to expect varying degrees of infection of the prostate wound in cases with infected bladders. It is hardly likely that a wound of such a nature bathed so freely by infected urine could heal without at least some superficial infection taking place. Unfortunately varying degrees of infection occur also in most of the cases in which the bladder was infection free before operation. This statement is verified by observing that the urine in practically all prostatectomy cases is more cloudy in the first glass and contains pus and bacteria for longer or shorter periods after closure of the abdominal or perineal wound.

The most common origin then though by no means the only one of the postoperative seminal vesiculitis and epididymitis is probably an extension of an infection from the prostatic wound. The course naturally is through the ejaculatory ducts to the seminal vesicles and ampulla of the vasa and then to the epididymides.

The case with which this extension occurs depends partially upon such things as the type of infecting organism and the patient's resistance to infection. But, it also depends upon the amount of trauma to which the seminal vesicles and vasa were subjected during the operation upon the extent of injury to the ejaculatory ducts and their surrounding tissues and upon the character of the wound which is left when the hypertrophy is removed. Indirectly it depends upon unobstructed urinary drainage from the bladder more especially during the first week or ten days after operation since distention of the bladder during this period might in the first few days after operation cause extravasation about the wound, and sooner or later either force infection through injured ejaculatory ducts, or by preventing free drainage of the wound intensify infection there and thus assist in extension of the infection.

## SYMPTOMS AND DIAGNOSIS

The prostate wound well might produce symptoms which could be mistaken for seminal vesiculitis and vasitis. During the first few weeks of the convalescence the fact that we are willing to refer all symptoms to the wound causes the seminal vesiculitis to be overlooked or at least ignored and unfortunately a plan for clearly differentiating the outstanding symptoms of each has not been outlined. However I believe that, by a careful study in each case some of the symptoms can be differentiated. When epididymitis occurs, we need no further evidence to prove the existence of an acute vesiculitis. A nagging pain in the lower part of the abdomen, rectum or testicles, is more apt to be from the vesicles and vas than from the wound. Fever could be produced by an infection of either the wound or of the vas and vesicles but intermittent attacks of fever often accompanied by slight chills are more likely to be from the latter. In at least one of my cases, the vesiculitis was mistaken for a pyelitis and I feel sure that in the future the discovery of such an existing infection will explain for me some of the elevations in temperature which I attributed to pyelitis or recorded as unexplainable.

Later in the postoperative course, the evidence of a continued vesiculitis is found in the products of inflammation coming from the posterior urethra, as pus, mucus and at times, organisms in such quantities and for such a length of time as one would not expect to obtain from an uncomplicated prostatic wound inflammation. These products the more easily gain entrance to the bladder through the relaxed or partially relaxed vesical orifice, and since they are mostly found there until urination begins they must of course be differentiated from those coming from bladder disturbances and from kidney infections.

A definite diagnosis can usually be made in the later convalescence by rectal examination and a study of the seminal vesicular secretion expressed by massage.

## PREVENTION

For the prevention of postoperative difficulties with seminal vesiculitis, it would probably be well to examine the seminal vesicles of

all cases coming up for prostatectomy so that a seminal vesiculitis would not be overlooked and in selected cases treatment could be administered with the idea of at least improving the condition before the operation.

The general measures now in use for getting prostatectomy cases in condition for operation serve the purpose of increasing their resistance and lessening postoperative complications. One suggestion, however might be added namely that one of the safest methods of washing out the posterior urethra in catheterization cases is to have the patient void. Though they can pass only a small part of the urine they should be encouraged to do so at least once or twice a day before the introduction of the catheter. Even the infected urine if it is acid and contains some of the urinary antiseptics or their products, is of some cleansing value for this purpose. The procedure would be of greater value if the bladder were filled through a catheter with warm boracic solution and the patient allowed to void and then with the catheter reinserted to empty the bladder.

Vaccines may be of value but I do not feel that my experience is extensive enough to warrant my approving or disapproving their use. The consensus of opinion has been I believe that they are rather ineffective in most genito-urinary infections but unless given in overdoses, they would be apt to do good rather than harm.

The type of infection can be controlled to a certain extent in cases with alkaline urine by giving acid sodium phosphate and injecting lactic acid bacilli into the bladder. For cases with other types of infection the routine urinary antiseptic given by mouth, the bladder irrigations and instillations commonly advocated can be most certainly of some service in preventing troublesome postoperative infections of the wound.

Of whatever importance these measures may be we have perhaps still as important ones to consider.

The character of the wound left after prostatectomy depends not only upon the operator's skill but also upon the size of the enlargement, upon whether it was largely penurethral or mostly intravesical and upon

how much difficulty was experienced in freeing the hypertrophy from the surrounding tissue or we might say upon how adherent the hypertrophied tissues were to the surrounding tissues and upon how tightly the vesical orifice contracts after the prostate is removed.

For the most advantageous results in healing, the prostatectomy wound like all other wounds, demands that surrounding tissues be bruised or injured as little as possible that no devitalized tissue or pockets in which infection can be harbored be left in the wound that no infectious material be drained into it, that free drainage be supplied continuously and that it be kept clean.

It is difficult in every case to prevent bruising of the tissues about the hypertrophy but every effort should be made to produce as little injury as possible not forgetting the bruising which the finger in the rectum may cause. With the attention concentrated upon the work of the enucleating fingers, it is not unlikely that unnecessary force will be employed by the fingers in the rectum when the other hand is straining to overcome unusual difficulties. The seminal vesicles and ampullae of the vasa usually lie between the rectum and the hypertrophied prostate and are therefore in position where they can be readily injured by unusual roughness.

Since undamaged ejaculatory ducts serve better to keep out infection their position in relation to the hypertrophy should be kept in mind, and when the necessary careful survey of the contour of the hypertrophy is made with the finger introduced into the bladder before beginning the enucleation an effort should be made to locate the verumontanum so that when possible the urethra can be torn in such a way as to prevent, as far as possible injury to that part of the urethra through which the ejaculatory ducts run. In some cases I know that it is possible to tear through the floor and lateral walls of the urethra just ventralward from the verumontanum before beginning the enucleation, thereby preserving the urethra about the ejaculatory ducts better than can often be done by the usual intra-urethral enucleation.

To assist in locating the verumontanum at operation the distance between the outer

part of the intravesical projection of the hypertrophy and the verumontanum can be noted at the routine cysto-urethroscopic examination made before operation.

To keep such an inaccessible wound clean after operation is naturally not easy. Direct lavage can best be obtained by the introduction of a small catheter through the urethra to just beyond the external sphincter allowing the irrigation fluid to flow back into the bladder through the internal sphincter. This should be employed as a routine. It can be done safely and satisfactorily provided the vesical sphincter has not contracted sufficiently to require force to cause the irrigation to flow through it. Where this contraction occurs instillations of suitable antiseptic solutions through the urethral catheter should be substituted for irrigations and the bladder should be irrigated through a small catheter passed through the suprapubic wound the irrigating fluid flowing back around the wound.

Where the sphincter has not been injured at operation or overstretched by the intravesical projection of the hypertrophy it may close sufficiently to prevent not only satisfactory lavage of the wound from the urethral side but also the free drainage of the wound into the bladder which is the only drainage supplied in the suprapubic prostatectomy cases. In a paper read at the 1922 meeting of the Southern Medical Association I briefly called attention to the difficulties which might arise as a result of the early contraction of the vesical sphincter. In the discussion, Dr Arthur Chute remarked that he saw no reason for preserving this sphincter in suprapubic prostatectomy and rather advocated severing it so that the prostatic wound would be open and thus be freely drained into the bladder. Certainly this might in certain cases supply the free drainage that good surgical technique demands and it is true that while the preservation of the internal sphincter is often necessary to prevent fistula or incontinence in perineal prostatectomy cases when the prostatic urethra is opened and the membranous urethra injured it is really not necessary to preserve it in suprapubic prostatectomy when the external sphincter is not injured and the perineal fistulae are not found.

In the light of the findings of Young and Wesson (5) concerning the vesical sphincter and the trigone, we do not have a true sphincter remaining to produce this closure about the vesical orifice, but posteriorly an hypertrophied trigone and laterally the muscle fibre of the longitudinal layer of the bladder. In the suprapubic enucleation of a large hypertrophy with an intravesical protrusion the circular fibers which assist normally in the formation of the sphincteric action would frequently be torn across. This would leave us a choice of cutting posteriorly laterally through longitudinal layers of fibers or behind through the abrupt termination of the usually hypertrophied trigone.

So far I have not tried this, but I am convinced that some method of overcoming such a pocket like formation is needed unless we can prevent troublesome infections developing there by employing instillations of small quantities of suitable antiseptics such as mercurochrome and acriflavine. I have been using these two in my few recent cases and I believe they have done some good.

In addition to the measures outlined for preventing the development of the severer infections in the prostatic wound and their extension to the vasa and vesicles, I wish to emphasize the importance of maintaining free drainage of urine from the bladder until the prostatic wound has had time to heal. Should the bladder become distended the urine of course would be forced back into the wound and extravasation probably occur. Therefore the abdominal wound should be left well open and a good sized tube leading to the bladder left in it. In a case to which I have referred in another paper the lips of a 24 hour old wound healed together in a few hours after the tube was removed in such a fashion as to cause the patient's bladder to fill and permit voiding. Such accidents are not infrequently followed by very annoying infections in and about the wound with very likely an extension of the infection to the seminal vesicles and epididymes.

The most effective treatment of post prostatectomy acute seminal vesiculitis would be to empty the seminal vesicle by gentle pressure with the fingers in the rectum. But there are in these cases two conditions which

do not exist in other cases of seminal vesiculitis and which make such massage not only more difficult but perhaps even dangerous when attempted soon after operation. They are the higher position in the pelvis of the seminal vesicles in prostatic hypertrophy cases and the presence of thrombi in the periprostatic veins.

If the lateral and middle lobes are much enlarged the ejaculatory ducts are considerably increased in length and the seminal vesicles lie high up in the pelvis. If the prostate is normally situated high in the pelvis (high as related to the ability to reach it by rectal palpation) and the hypertrophy has carried the vesicles still higher massage is out of the question. But regardless of their position any rectal manipulation must be carried out with the greatest care when made shortly after the operation on account of the danger of breaking off parts of thrombi which may have formed in the veins which are normally so abundant about the prostate particularly on the ventral surface and when any difficulty is experienced in carrying out this method of treatment it had better be deferred until later in the convalescence. Just how long after the operation before this risk of producing emboli becomes negligible I cannot say but I do know that in many cases the seminal vesiculitis continues to exist unless curative treatment is instituted. Later on then in the convalescence massage of the seminal vesicles should be begun and the condition treated very much as any non tuberculous seminal vesiculitis is treated. Bladder and urethral irrigations should be used but it is much better to wash out the urethra by having the patient void after filling the bladder with an antiseptic solution than to force the solution back through the urethra with hydraulic pressure. Hot rectal irrigations are helpful. Instrumentation of the urethra with sounds and Kollmann dilator will probably be found useful and in persistent infection vasotomy with injection of the seminal vesicles may become necessary.

Finally in view of the difficulties in treating acute seminal vesiculitis in these cases, and the inconvenience and, as the case may be, the more or less serious consequence of its occurrence we should make a greater effort

than is now being made to prevent its development. We should recognize its appearance sooner and more frequently and develop new methods of prevention and treatment.

#### SUMMARY

Though some attention has been given to the prevention of infection and treatment of infected prostatic wounds the importance of postoperative acute and chronic seminal vesiculitis has been disregarded. This condition occurs most often through an extension of an infection from the prostatic wound though not infrequently a chronic infection exists before operation.

Epididymitis, which is practically always the extension of an infection in the seminal vesicles and vasa has been treated as an independent complication.

Such a vesiculitis is capable not only of producing in the acute stages an epididymitis but also of causing chills and fever. At times even high elevations of temperature are found, either intermittent or continuous, which are frequently ascribed to pyelitis, cystitis, or infections of the prostatic wound. Pain or discomfort in the lower sides of the abdomen in the testicles, perineum or rectum are generally present. The chronic vesiculitis usually keeps up a posterior urethritis and in this way or by itself causes discomfort on and an increased frequency of urination.

In making a diagnosis in the early post operative period one must recognize the difference between the symptoms arising from the prostatic wound and those from the vesiculitis. In the postoperative stage the diagnosis is made by the urine when voided by the local and referred pains and discomforts and by rectal examination and a study of the seminal vesicular secretion obtained by massage. An epididymitis is at all times sufficient evidence of the existence of a vesiculitis.

The means of preventing this complication are:

1. Before operation. Infection of the vesicles is avoided by suitable treatment of inflammation of the bladder and urethra, treating as far as possible all seminal vesicular infections before operation. Infections of the bladder and posterior urethra are treated so

that they will cause as little trouble as may be after operation. The usual method is employed of improving the patient's physical condition and increasing his resistance to infection.

2. At operation. When possible the posterior part of the prostatic urethra is torn across before beginning the enucleation so that the urethra about the ejaculatory ducts will be injured as little as possible. The operator should avoid bruising the periprostatic tissues, ejaculatory ducts and seminal vesicles by unnecessary roughness from the rectal and enucleating fingers. He should leave no devitalized tissue in the wound. At times, perhaps, incision is made of the diaphragmatic like collar resulting from the more or less immediate resumption of function of the vesical sphincter which causes the prostatic wound to be closed in and to lack the free drainage which would seem desirable.

3. After operation. Free bladder drainage prevents distention of the bladder which is apt to cause extravasation about the wound, severer infections of the wound seminal vesiculitis, epididymitis, etc. Irrigation of or instillations into the prostatic wound and bladder is suggested.

Although the emptying of a seminal vesicle by massage is indicated whenever an acute, non tuberculous, descending epididymitis occurs it must be recognized as a difficult and even dangerous proceeding in these cases when attempted shortly after operation and should be attempted only by those well trained and skilled in this procedure.

Some weeks after operation, however, there is less danger and massage of the vesicles, irrigations of the urethra and bladder, hot rectal irrigations and, in some cases, instrumentation of the urethra and injection of the vesicles by vasotomy should be employed.

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## THE PATTERN OF WEAKNESS OF THE HAND IN ULNAR AND MEDIAN NERVE LESIONS

By LEWIS J. POLLOCK, M.D. CHICAGO

Associate Professor of Nervous Diseases Northwestern University Medical School

**D**UAL innervation of muscles synergistic muscular supply and supplementary movements make the interpretation of the degree of injury to the ulnar and median nerves difficult. Particularly difficult is the interpretation of weakness in the thumb and fingers.

Dynamometric examinations of the phalanges were made in a considerable number of cases of injuries to the ulnar and median nerves and a review of a number of available records of these examinations has been productive of a few conclusions seemingly worthy of report.

The strength of a movement of any of the phalanges was ascertained by a spring scales registering pounds or grams.

The figure obtained was marked upon an imprint of the hand in its appropriate place. This method of examination and recording has been found to be very satisfactory in affording a comprehensive and accurate description of motor power (Fig. 1).

Fairly complete records of 86 cases were found. Of these 28 were cases of injury to the median nerve, 33 to the ulnar nerve and 25 to the ulnar and median nerves combined.

The cases of injury to the median nerve may be divided into four groups and analyzed as follows:

1. Four anatomical sections confirmed at operation. Sensory loss was complete, the isolated supply of pain sense of the median nerve being interpreted as the distal and part of the second phalanx of the index and middle fingers. Great weakness or paralysis in the distal two phalanges of the index finger and varying strength in the phalanges of the middle fingers was found. Movement of the distal phalanx of the thumb was practically absent.

2. Twelve severe lesions were found at operation not to be anatomical sections. In general these showed greater strength of the

index finger but in three no difference from cases of anatomical section could be seen. Otherwise phalangeal movements of the fingers were of no value in interpreting the degree of injury. Flexion of the distal phalanx of the thumb was weak but greater in strength than in the first group in 7 cases. The second phalanx of the thumb was stronger in 8 cases and not recorded in 1 case. Sensory loss was incomplete in all.

3. There was 1 case of severe but incomplete lesion with slight sensory recovery but little movement in the thumb and definite contraction of the palmaris longus.

4. There were 11 cases of recovering or partial lesions not operated upon. In general the movements of the phalanges of the index and middle fingers were stronger. The opponens pollicis showed recovery in 4 and the flexor carpi radialis in 3. In only one instance was the sensory loss complete.

In 23 of 24 incomplete lesions sensory regeneration, interpreted in terms of isolated supply had begun. In only 1 case was there evidence of motor regeneration in the absence of sensory recovery (Fig. 2).

The ulnar nerve injuries were as follows:

1. Eight cases of complete anatomical section verified by operation. The weakness in



Fig. 1. Method of recording the results of examination. The positions indicated by the various letters denote the following muscles: hypothenar muscles; 1, opponens pollicis; 2, lumbricals; 3, first dorsal interosseus; 4, remaining interossei; 5, adductor pollicis; 6, flexor carpi ulnaris; 7, palmaris longus; 8, flexor carpi radialis.

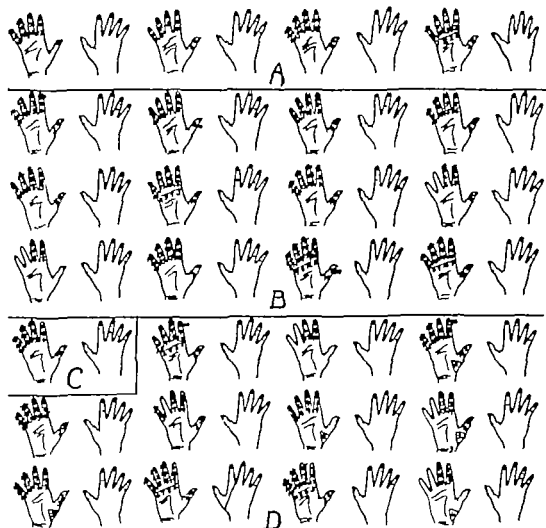


Fig. 3. Severe lesions of anatomical section confirmed at operation. A, sensory loss complete. B, severe lesion not anatomical section confirmed in operation.

C, severe but incomplete lesion, marked sensory loss. D, recovering or partial lesion, sensory loss complete in only one.

the two inner fingers varied greatly at times as much as 5 pounds of flexion in the proximal phalanges was observed (but never when the distal phalanges were extended).

Lateral movements of the fingers were very feeble with the exception of the index finger where the first interosseus received some supply from the median. The sensory loss was complete.

2. Severe lesions, not anatomical sections. Although the strength of the little finger was

frequently greater than in Group 1 in 4 the difference was unappreciable. In 5 the strength of the proximal phalanges was definitely greater. The strength in the ring finger in general was greater than in complete lesions but not with sufficient constancy to be of absolute prognostic value. Sensation was completely lost.

3. Six cases of compression with only partial sensory loss. In 2 there was practically no loss of power in the phalanges, in 1 greater

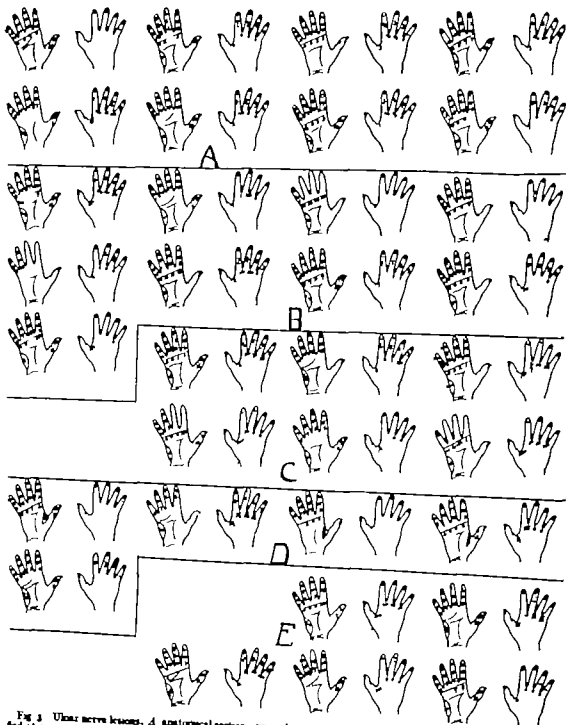


Fig. 3. Ulnar nerve lesions. *A* anatomical section effected at operation, complete sensory loss. *B* severe lesion not anatomical section, complete sensory loss. *C*, compression of ulnar nerve, arised at operation, partial sensory

loss. *D* partial and recovering lesions not verified by operation, complete sensory loss. *E*, cases similar to *D* with some sensory regeneration. Only 4 cases showed sensory regeneration in the absence of motor recovery.



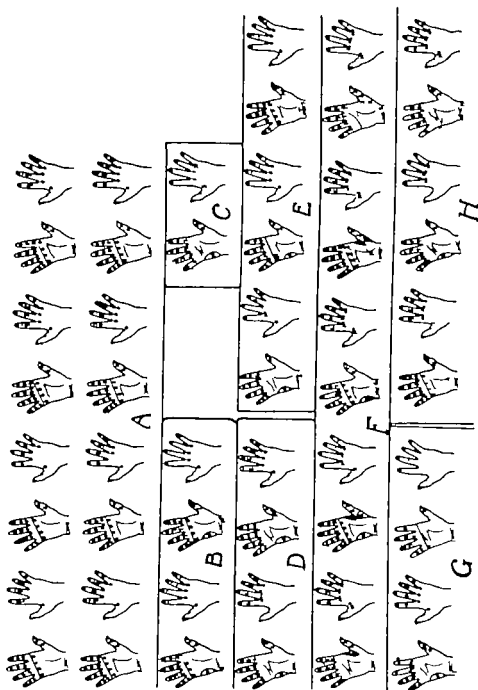


Fig. 4. Uterine and median nerve lesions. 4 anatomical sections, complete sensory loss. B incomplete but sensory loss complete, sensory loss over uterine, incomplete over median, C, incomplete but sensory loss incomplete sensory loss over uterine and median. D incomplete but sensory loss complete sensory loss over uterine and median. E complete uterine sensory loss, median, sensory loss over uterine complete, over median incomplete (all

also, group confirmed at operation) F incomplete or recovering lesion sensory loss over uterine complete, no loss over median in three and only partial loss in two. G, complete uterine sensory loss and incomplete sensory loss over median with regeneration of uterine nerve. H incomplete uterine and median sensory lesions, no sensory loss in uterine slight sensory loss median

strength in the first dorsal interosseus than in complete lesions (6 pounds) and in 2 greater strength in abduction of the little finger (one or more pounds) than in complete lesions. In only 2 was sensory regeneration present and motor recovery absent.

4. Ten cases of partial and recovering lesions not coming to operation. Of these 5 had complete sensory loss, motor regeneration was shown by all, by relatively greater strength in the phalanges in 2, by return of power in the adductor pollicis in 3, by greater strength in abduction of the little finger than observed in complete lesions in 1.

The remaining 5 cases showed some sensory regeneration. In 3 of these there was definite return of some motor function: in the abductor minimi digiti and adductor pollicis in 1 and in the flexor carpi ulnaris in 2. The remaining 2 showed no difference in motor pattern from complete lesions.

Of 25 incomplete lesions, sensory regeneration could be demonstrated in 11 and of these 1, 7 showed definite motor regeneration. Only 4 cases showed sensory regeneration in the absence of motor recovery (Fig. 3).

The cases of injury to the ulnar and median nerves may be analyzed as follows:

1. Eight anatomical sections confirmed by operation. There were no movements of the phalanges and there was complete sensory loss.

2. Two cases of incomplete but severe lesions. The sensory loss was complete in the ulnar nerve and incomplete in the median. There was movement in some of the phalanges of all fingers and in the flexors of the wrist, flexor carpi ulnaris in 1, palmaris longus in 1 and palmaris longus and flexor carpi ulnaris in the other. In the first movement of the second phalanx of the thumb. In the other no indication of motor recovery of the ulnar was observed.

3. One case of incomplete but severe lesion, with incomplete sensory loss of both ulnar and median nerves. Movements of phalanges of all fingers, strong flexion of second phalanx of thumb and fairly strong adduction of thumb.

4. Two cases of incomplete but severe lesions with complete sensory loss of ulnar and median nerves. There was movement of all

the phalanges in one flexion of the distal and second phalanx of the thumb and strong flexion of the proximal phalanges of the little and ring fingers. In the other flexion of the second phalanx of the thumb but no indication of recovery of the ulnar.

5. Three cases of complete ulnar and incomplete median lesions. In all the sensory loss of the ulnar was complete and the median incomplete. In 2 movement of the palmaris longus or flexor carpi radialis could be seen. In the other strong flexion of the distal phalanx of the thumb was found.

All of the foregoing lesions were confirmed at operation.

6. Five cases of incomplete or recovering lesions of ulnar and median nerves. In all the sensory loss of the ulnar was complete. In 3 there was no sensory loss in the median and only partial loss in 2.

The abduction of the thumb had returned in 4, the abduction of the little finger in 1, the flexor carpi ulnaris in 1, the opponens in 3, the palmaris longus in 3 and the flexor carpi radialis in 2. The phalangeal movements were of no assistance in determining which of the two nerves were only partially injured.

7. One case at one time showed complete sensory loss in the ulnar and median and motor indication of partial injury to one or both nerves, or complete section of one and partial of the other. Two months later there was complete ulnar analgesia and incomplete median, with return of power in the little and ring fingers and the first phalanx of the thumb.

8. Three cases of incomplete ulnar and median lesions. No sensory loss in the ulnar and slight loss in the median. One showed a return of movement in the little and ring fingers, two in the flexor carpi ulnaris, all in movements of the thumb and two in the palmaris longus. In only one case was sensory regeneration present in the ulnar distribution when motor examination gave no indication of recovery.

In 15 of 17 cases of partial lesions of the ulnar and median nerves the sensory loss of the median was incomplete. In only 4 of these seventeen cases was the ulnar sensory loss incomplete. In only 2 cases of severe but incomplete lesions of the ulnar and median

nerves was the median sensory loss complete and motor regeneration evident (Fig 4)

#### COMMENT

*a. Ulnar nerve lesions* Physiological interruption cannot be differentiated from anatomical section by the strength of movements of the phalanges of the fingers

In recovering and partial lesions, relatively greater strength in the phalanges is observed but may at times be an inaccurate guide to the severity of the lesion. Relatively greater strength in the first dorsal interosseus, or in the abductor of the little finger is an accurate guide as to the incompleteness of a lesion. Of course any movement of the flexor carpi ulnaris or adductor of the thumb which is not supplementary in character determines an incomplete lesion. Of 16 partial or recovering lesions, 13 showed motor phenomena indicative of the severity of the lesion. In 9 severe cases not due to anatomical section the motor phenomena were suggestive of partial lesion in 5 but conclusive in none.

Of 16 cases of recognized partial or recovering lesions 11 showed incomplete sensory loss. Sensation was completely lost in all severe partial lesions. Where sensory regeneration had occurred usually motor recovery could likewise be demonstrated.

*b. Median nerve lesions* Physiological interruption cannot be differentiated from anatomical section by the strength of the movements of the phalanges of the fingers. Although in a considerable number of cases the movements of the index finger were stronger this could not alone determine the character of the lesion. Return of function in the opponens pollicis would indicate a partial or recovering lesion but because of supplementary motility is very difficult to determine. I wish to call attention to a supplementary movement producing abduction of the thumb at right angles to the palm which I have not before noted. When the metacarpophalangeal joint of the thumb is partially ankylosed so that no flexion or extension in the plane of the palm is possible contraction of the extensor longus pollicis and the extensor

osus metacarpi pollicis produces abduction of the thumb as above described.

Sensory regeneration or incomplete sensory loss in the area supplied by the median nerve is almost constant in complete lesions and in otherwise physiologically complete ones. I.e. sufficiently severe partial lesions to come to operation. In a large proportion of partial or recovering lesions sensory regeneration is present when motor phenomena give no indication of regeneration.

*c. Ulnar and median lesions* When observed sometime after injury (more than 5 months) it would appear that anatomical section of both ulnar and median nerves produces complete paralysis of all the phalanges of the fingers and thumb and severe lesions, not anatomical sections, show some movement in some of the phalanges of all of the fingers.

In incomplete lesions of either ulnar or median nerves, weak movements of the phalanges of the fingers if interpreted alone are insufficient guides as to whether one of these nerves is severed and as to which one may be severed.

As in isolated lesions of the median nerve, so when combined with an ulnar nerve lesion, it was seen that in partial or recovering lesions and in more than half of the severe lesions, not anatomical sections, incomplete sensory loss in the median distribution was present.

Only a few of the cases of incomplete ulnar and median nerve lesions showed incomplete sensory loss in the ulnar distribution, and in only 1 of 17 cases was this the case when phenomena of motor regeneration were inconclusive. Only one severe incomplete lesion showed incomplete sensory loss of the ulnar. In complete lesions of the ulnar and incomplete of the median when sensory regeneration was demonstrable, motor regeneration was likewise present.

It is emphasized that recovering or incomplete lesions of the median nerve may almost regularly be determined by sensory examination, whereas in ulnar lesions this rule does not apply. Contrary to the generally accepted statement that signs of sensory regeneration are first to appear

THE SURGICAL TREATMENT OF LATERAL CERVICAL FISTULÆ<sup>1</sup>

By FREDERICK CHRISTOPHER, M.D. F.A.C.S. CHICAGO

Assistant Surgeon St. Luke Hospital Chicago, Junior Surgeon Excelsior Hospital, Evanston, Illinois.  
Assistant in Surgery University of Illinois Medical School

LATERAL cervical fistulæ frequently in correctly termed "branchial fistulæ," are congenital fistulæ, the internal openings of which are in the pharynx and the external openings of which are in the skin of the neck, generally in the region of the lower portion of the sternomastoid muscle. In addition to these complete fistulæ there are also incomplete internal fistulæ which open internally only and incomplete external fistulæ which open externally only. Median cervical fistulæ form a separate class of fistulæ and are not taken up in this paper.

In the last 100 years, congenital cervical fistulæ and cysts have afforded a favorite subject of contributions to surgical and pathological literature. Over 400 authors have added the results of their researches and experiences so that at present the knowledge of this subject is very complete. There has been a tendency however of many recent authors to overlook the work of other contributors in this field and to be unconscious of the necessity for discarding old conceptions.

Probably the first reported cases were the two by Hunzowicki in 1789 (23). In 1819 Dzondi (13) described four cases of fistulæ trachæ congenitæ, because he erroneously thought that the internal opening of these fistulæ was in the tracheæ. In 1833 Acherson (1) published his "De Fistulis Collis Congenitis" and in this paper contributed two important ideas. First, he distinguished between median and lateral fistulæ and second he was the first one to associate lateral cervical fistulæ with incomplete closure of the branchial clefts. The creation of the term "branchial fistulæ," however remained to be the work of Heusinger (21) in 1864.

In the human being (30) it has been formerly taught that the pharyngeal cavity is bounded in early fetal life by four plates on each side, each pair of plates constituting a branchial arch, of which there are consequently four; they are, in other words, columns of tissue separating adjacent clefts

from one another. The branchial clefts have been said to unite during early fetal life with the exception of the first one from which is formed the Eustachian tube the cavity of the tympanum, and the external auditory canal—a fistula but for the tympanic membrane. From the second branchial arch comes the styloid process, the stylohyoid ligament and the lesser horn of the hyoid bone. The body and greater horns of the hyoid are formed out of the third arch while the fourth aids in forming the soft tissues of the neck. The glands tracheæ and larynx are formed from other growth centers.

Repeated observations and embryological contributions served to strengthen the hypothesis that lateral fistulæ and cysts resulted from the incomplete closure of a branchial cleft, until this hypothesis came to be accepted as a truth. The second branchial cleft was thought to be the one most commonly concerned in these fistulæ, although the first (16) has been mentioned.

In 1912 Wenglowski (35) published the most important single contribution on the etiology of lateral cervical fistulæ. His work has compelled us to forsake completely the branchiogenic theory of origin. Wenglowski's paper was the result of five years of intensive work. He collected and studied (in his investigation of both median and lateral cervical fistulæ) 78 embryos ranging in length from 2 millimeters to 49 millimeters. Serial sections were made of these and from the sections, wax plates which, in turn, when built up made large wax models. He also made serial sections of 147 child cadavers and 59 adult cadavers. Moreover he studied 21 cases of actual neck fistulæ or cysts.

His conclusions are of such interest and importance that they are given herewith in full.

1. In man there develop five to six branchial arches and the same number of clefts or grooves. *The grooves are not open.*

*(Under the author's)*

2. The neck sinus—*sinu cervicalis*—is built by the approximation of the lateral borders of the neck, breast and the under border of the third arch and not the second as His contended.

3. In embryos as well as in adults the branchial apparatus does not lie from above downward but from front to back. Its inferior border and the inferior border of that part which arises from it is made by the line which passes through the inferior border of the hyoid bone.

4. In the beginning of the second month the entire branchial apparatus as such disappears. It may leave behind it portions of many layered epithelium, or even particles of cartilage lying freely in the tissue. All the vestiges are usually found above and dorsal to the hyoid. *The branchial apparatus cannot leave remnants in the neck below the hyoid.*

5. The thymus originates from the third pharyngeal pouch in the form of a *large canal running obliquely from the lateral pharyngeal wall to the sternum* where the characteristic thymic substance begins to develop.

6. The thymic duct usually disappears either partly or entirely. Occasionally the entire duct or one of its part (more frequently the lower) may persist.

7. *The vestiges of the thymic duct may change into a lateral cervical fistula or cyst.* If the entire thymic duct persists a complete fistula will result when only a part of it an incomplete.

8. The anatomical situation of the lateral fistula corresponds very closely with the course of the thymic duct. The walls of the lateral fistulae are generally covered with squamous epithelium but ciliated epithelium is occasionally found.

9. *The lateral thyroid lobes also have a short canal which disappears early.* By analogy with the thymic duct one can consider that this canal may also persist and form fistulae and cysts. The inner opening of such fistulae is found lateral to the entrance of the larynx.

Hereditry has been thought by many observers to play an important part in the etiology. Vaughn (34) reports a case of unusual

interest in this connection. His patient was a young woman with a bilateral fistula. Her grandmother had one fistula on the right side of the neck. Her sister had one fistula on the left side and a daughter one fistula on the left. The anomaly is said to be more frequent in females than in males and may first be perceived as late as at 10 to 20 years of age. Lateral cervical fistulae are much more rare than median (4).

The skin opening of a lateral cervical fistula is on the front of the neck and is usually pinpoint in size. It is generally between the midline and the sternomastoid muscle and between the hyoid bone of the larynx and the sternum but rarely ever below the clavicle.

The tract then passes upward and inward where it may come in close relationship with the carotid sheath and jugular vein. It crosses the carotid bifurcation and passes beneath the digastric muscle. It is near to the hypoglossal and glossopharyngeal nerves and enters the lower pharynx or posterior palatine arch near the tonsil.

The fistulae may be so large that crumbs of bread etc. can pass through (15). Leever (30) reported an interesting case in which the patient could pass a bent needle from inside the pharynx to the outer opening just above the sternoclavicular articulation and draw it out. The sound could be passed only 3 centimeters into the outer opening.

The fistulae are lined with epithelium, part of which is cylindrical and the other part squamous. Outside of the epithelium is a connective tissue layer and occasionally mucous glands and cross-striated muscle are found. Leeger believes the endoderm plays the principal rôle in the origin of the fistulae.

In order to determine whether an external fistulous opening communicates with the pharynx, butter or other fluids which may be tasted (22) have been injected.

The injection of the fistula with barium and subsequently X raying it was mentioned by Dowd (16) in 1916. Gilman (17) shows an excellent roentgenogram illustrating this diagnostic procedure to which Leriche and Badolli (29) have given the term *Fistulography*.

Leegard (27) says that the right side is more frequently the side of lateral fistulæ than the left, and believes the fact to be probably explained in the normal embryological development.

The rising of the fistula with deglutition is said to signify that the fistula is a complete one.

Related to lateral cervical fistulæ are three groups of congenital anomalies (a) congenital ear fistulæ, (b) auricular appendages (c) congenital skin growths on the side of the neck.

The patients generally come for treatment because of the annoyance of a periodical purulent discharge on the skin of the neck. Perhaps a more important reason for dealing with them is that they undoubtedly constitute foci of septic absorption and are a detriment to the general health. Eddowes (14) reports the case of a nurse aged 30 who had an occasional regurgitation into her mouth of matter like the discharge from a gum boil and remarks that "it was obvious that the patient whose physique was otherwise good, was having her health ruined by the filthy pouch" and he accordingly referred her to a surgeon.

Karawaki (24) called attention to the difficulty of the surgical care of a carcinoma developing out of such a fistula.

Although one case of alleged spontaneous healing of a fistula has been reported it may safely be said that they never heal.

Many methods of treatment of lateral cervical fistulæ have been tried. The earlier observers avoided surgical intervention because of the proximity and even adherence of the tract to the important structures of the neck. One writer Chalot (7) even held total extirpation to be impossible. Guth (18) reported the case of a soldier discharged from the army because of a lateral cervical fistula and said that an attempt to dissect out the fistula would have been "folly" because of its length and proximity to the vessels and nerves.

Numerous substances were employed for injection into the fistulæ. Iodine, alcohol and trichloroacetic acid have been used. In Dzondz's (12) case which was injected with



Fig. (at left) Model of the pharynx, trachea, and the organs which develop from them in a 4 millimeter embryo.

Thymus, *b*, oesophagus, *c*, duct of the thymus, *a*, lateral lobes of the thyroid, *f*, duct of the thymus, *e*, pharynx, *d*, thyrological tract, duct of the thymus, *g*, duct of lateral lobes of thyroid, *h*, lateral lobes of thyroid, *m*, duct of the thymus, trachea, thymus (Wengowski).

Fig. Model of the pharynx, oesophagus, trachea and the organs which develop from them in a 30 millimeter embryo, lateral view. *a*, Oesophagus, *b*, duct of the thymus, remains of the upper part of the duct of the thymus, *c*, larynx, *d*, lateral thyroid lobes, *e*, median thyroid lobes, *f*, trachea, *g*, thymus (Wengowski).

mercuric nitrate the termination was fatal. Chevers (8) reports a case apparently cured by infection of croton oil. The incomplete fistulæ lend themselves better than the complete to cure by injection.

Electrolytic treatment was used as early as 1885 by L. Lefort (28) and Lichtwitz (37) reported a case cured by this method.

As early as 1893 Karawaki (24) stated that radical extirpation was the only sure cure and at the present time this represents the consensus of opinion of surgeons (25).

Various surgical procedures have been employed in the excision of lateral cervical fistulæ and a consideration of them impresses one that each has its merits according to the obstacles encountered. No one operation can be recommended to the exclusion of others.

As the tract is very thin walled and difficult to distinguish from adjacent structures some method must be adopted of identifying it during the dissection. The best method is to inject the fistula with methylene blue until the coloring matter appears in the pharynx (in the case of the complete fistulæ). A blunt hypodermic needle is useful for the injecting

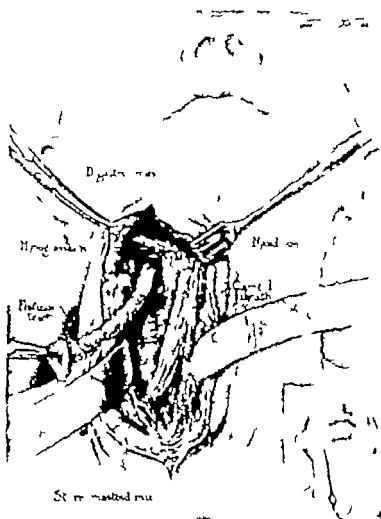


Fig. 2. Shows exposure of fistulous tract and its relations. Clamp on end of fistula should be shown as clearing the tract to prevent escape of fistula contents instead of as it is. Insert shows location of opening of tract and base of incision.

Dowd (10) has passed a urethral catheter into the fistula and dissected down on this for a guide. In incomplete fistula S. W. McArthur (32) has injected molten paraffin which when hardened made a good method of locating the tract.

A single vertical or slightly oblique incision, 8 to 10 centimeters in length, immediately over the fistulous tract is probably the incision of choice. Broca (3) used two separate small incisions following the tract from one to the

other under the skin. J. Douglas (9) reported a case dissected out through two small incisions.

Throughout the operation it is necessary to consider the inside of fistula unsterile and to avoid contaminating the wound with any of the contents of the tract. With this end in view it is best to start the incision with a small circular cut around the fistulous opening and close the latter at once with a hemostat. Traction is now put upon the tract

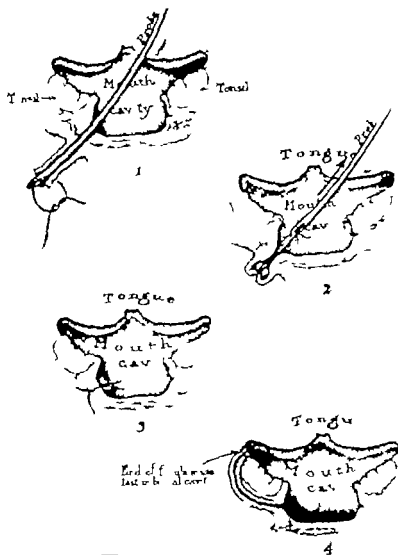


Fig. 4. Diagram showing steps in the Hacker and Koenig operation shown in cross section at level of tonsil. The dissected fistulous tract has been amputated and the stump has been made fast to the ry. of the probe. Probe drawn into mouth and fistula being inverted. 3 Tract has been entirely inverted, ligated, and cut off. 4 Procedure in the Koenig operation. The stump of the tract has been brought anterior to the tonsil and passed into the buccal cavity where it has been made fast.

and it is carefully dissected free from the adjacent structures. Blunt dissection is the method of choice and a cut should only be made after careful identification of the tissues to be severed. The ingenious fistula clamp of Balkhausen (3) may be of use though mention is not made of its being so used.

During operation the tract may become a mere fibrous cord as in Cadet Boissac's (5) case. It may be necessary to resect part of the hyoid bone (25). Small portions of bone or cartilage may be found in the tract (11).

If possible the dissection should be carried on under the posterior belly of the digastric





Fig. 3. (Patient M. C.) Showing situation of scar which has slight tendency to keloid formation.

muscle taking care to avoid the hypoglossal nerve and be extended to the pharyngeal wall (Fig. 3). At this juncture the freed tract could be divided between clamps about 2 centimeters distal to the internal orifice and the proximal cut end cauterized.

The manoeuvre which constitutes the essential feature of the von Hacker (19) operation should now be employed. The proximal cut and cauterized end of the fistula is cautiously opened so as not to spill fistula contents in the wound. A probe bearing a piece of ligature threaded through it eye is now passed through the fistula into the mouth. The ends of the ligature are made fast to the cut end of the fistula by transfixion (Fig. 4 1). The probe is now drawn out through the mouth and gentle steady traction made upon the ligature. This causes the fistula to become inverted as a glove finger is turned into itself (Fig. 4 2) and the inverted end is finally drawn into the pharyngeal cavity. Here the fistula is ligated and cut off short leaving protruding into the pharynx, a short stump (Fig. 4 3) which soon sloughs and

atrophies to the normal level of the pharyngeal mucous membrane.

The above method is decidedly the method of choice. Occasionally however it is impossible to invert the fistula even though it has been entirely mobilized. In this event, its pharyngeal orifice is excised with a small portion of the adjacent mucous membrane and the latter is closed with a purse string.

In many cases it is found that after the tract has been freed part way it is so adherent, as the result of previous inflammation that it is impossible to dissect it out entirely. If this be the case the Koenig operation (26) should be used. In this procedure the freed distal end is passed through the mucous membrane of the mouth in front of the tonsil and is sutured there. This transforms the pharyngeal cutaneous fistula into a curved sinus having a pharyngeal opening at one end and a buccal at the other (Fig. 4, 4) and all external discharge is done away with.

Cates (6) reports an interesting case of a lateral cervical cyst which was adherent to the carotid sheath. After the surgical removal the pupil on the affected side remained dilated after operation for a long time and interfered with vision.

The following is the report of a case operated upon by the von Hacker method.

Patient Maria C. age 7 was admitted to the E. Boston Hospital on May 9, 1913 with diagnosis of lateral cervical fistula. When the patient was 3 weeks of age the mother noticed a small opening on the right side of the neck. At this time there was no discharge. When the patient was 3 years of age the mother began to notice serious discharge on the child's dresses but never noticed the discharge on the neck itself. Since February 1913 the discharge has become profuse and purulent and the patient has been noticed to be leaving her throat frequently. The past history is as a rule except for few sore throats scarlet fever measles and mumps.

The physical examination is entirely negative as for the neck. There is opening in the skin of the neck about millimeters in diameter and situated about 75 centimeters to the right of the midline and about half-way between the hyoid cartilage and the suprasternal notch. On deglutition the tract communicating with the skin opening became tense and was seen to extend upward and posteriorly into the tissues of the neck. An attempt was made either to probe this tract or to inject better substances. The urine was negative. Nose and throat cultures were negative.

On May 10, 1923, the patient was operated on (Dr. Christopher) nitrous oxide and ether anesthetic being used. The fistula was injected with methylene blue and this promptly appeared in the nasopharynx demonstrating the fistula to be a complete one.

A vertical incision was extended upward from the orifice of the fistula and the tract carefully dissected free from the adjacent structures after the manner described above. After the tract had been mobilized it was severed some 2 centimeters from the pharyngeal end. A probe was now passed through the fistula into the nasopharynx, but not without some difficulty and the tract was inverted as in the von Hacker method, ligated, and cut off (Figs. 1 and 2).

The wound was closed without drainage and healed rapidly save for a small amount of superficial infection which quickly subsided. The pathologist (Dr. J. L. Williams) reported the sinus to be lined with chronic granulation tissue and as having a considerable amount of lymphoid tissue in its wall. In places there is a layer of mucous membrane covering the lymphoid tissue which resembles in some respects the mucosa of the large bowel.

The patient was discharged from the hospital on the third day postoperatively and came to the office for a few dressings afterward. When last heard from in June, 1923, the patient was in excellent health and the wound entirely healed.

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## MAIGNANT TUMORS OF THE PAROTID GLAND WITH ANALYSIS OF A CASE

R. CHARLES A. PORTER, M.D. F.A.C.S. AND EDWARD D. CHURCHILL, M.D. Boston

THE nature and origin of malignant epithelial tumors of the salivary glands is a subject which shares the uncertainty still surrounding the histogenesis of the so-called mixed tumors. Through the studies of Krompecher and more recently of Masson and Peyron it has been satisfactorily established that the mixed tumors are epithelial in nature and the older view of endothelial origin fostered by Volkmann with the support of a large number of German writers and more recently resurrected by Martini is generally considered untenable. It has been shown by the above authors that the mucoid and cartilaginous areas in the mixed tumors are derived from the epithelial element by unusual metaplasia.

There is still uncertainty regarding the origin of the epithelial cells giving rise to the mixed tumors, and as Twining states it appears that "no single source of the mixed tumor meets all the requirements." They have been considered by Hinberg, Chevassu, Wood and others to arise from branchial remnants this origin being suggested by the presence of cartilage and bone and by the complete isolation from the gland with definite encapsulation which may be present. The cytological studies of epithelial metaplasia by Masson and Peyron make it unnecessary to invoke this origin to explain the cartilage and bone. Forgue and Roux hold to the theory of embryonic origin and believe the tumors to be true teratomata not entirely of epithelial origin. An origin from the adult epithelium of the salivary glands is described by Pérochard and other French writers while Wilson and Willis and others believe that there is considerable evidence to support the theory that the tumors are mesotheliomata having origin in embryonic glandular rests. From evidence obtained in a combined experimental and pathological study Fraser would assign their origin to glandular ducts.

The usual course of a mixed tumor is one of relative benignity but instances of a change

from a slowly growing tumor of many years duration to a malignant growth are not infrequent. The case reports of Nasse and Hinsberg suggest such an occurrence and Landsteiner reports a case of rapid growth occurring in a tumor of 16 years duration in which he was able to demonstrate cartilage in the "old part" and squamous cell carcinoma in the infiltrating part. Since this time there have been several case reports of malignant mixed tumors but little is known of their histology. The portion which becomes invasive is usually more cell rich and poor in connective-tissue stroma than the original tumor. Although the malignant change may be sarcomatous as described by Wood, most cases are epithelial and appear clinically as carcinomata. The tumor may take the form of strands of round or polygonal cells (Brandes, Briddon) or may show alveolar structure as the case LeDentu described as an alveolar sarcoma. The epithelial growth in Landsteiner's case was of squamous cell type and Ehrlich reports a tumor showing squamous cells in one place and cylindrical epithelium in another both of cancerous nature.

Metastases of malignant mixed tumors take place through the blood stream rather than to the regional lymph nodes. Of 8 cases from the literature which are quite clearly of mixed tumor origin and in which metastases are described 6 showed blood borne metastases (Budde, Chiari, Foerster, LeClerc, LeDentu and Payne) while only 1 showed involvement of cervical lymph nodes (Brandes and Wood). The interesting case of Griffini and Trombetta showed both glandular and pulmonary metastases. The histology of the metastases is seldom given in the case reports but is usually similar to that of the malignant portion of the primary tumor (Heineke) and is of carcinomatous structure. The metastases in the case of Griffini and Trombetta were cartilaginous, but as pointed out by Wood may have been direct extensions of the primary growth.



Fig. 1 (left) Tumor cells in close proximity to normal parotid acini. Cancer.  
 Fig. 2 Small epithelial cells in many pleomorphic lines with hyaline degeneration and atrophy of cell columns. Cylindroma.

A large number of salivary gland tumors have been described under the term cylindroma. The peculiar structure designated is an arrangement of small darkly staining polyhedral cells in plexiform strands or broad sheets with the enclosure of small areas filled with mucus. Hyaline degeneration is frequently seen in the connective tissue stroma. These characteristics are suggestive of basal cell carcinoma or adenoid cystic epithelioma. The origin and nature of cylindromata was for years the subject of active controversy especially among German writers. Loewenbach first definitely emphasized their carcinomatous nature and describes two cases of submaxillary cylindromata the origin of one of which is traced to the ducts and the other to the acini of the gland.

Recently Heinke in an excellent review of the subject considers that they are varieties of mixed tumors and calls attention to the many types of intergrades that are described. Fraser believes that the process of hyaline deposition in cylindromata is closely allied to the myxomatous and cartilaginous changes in mixed tumors. Ewing describes them simply as adenocarcinoma and does not attempt to differentiate what he considers to be a primary adenocarcinoma growing with basal cell metaplasia from a basal cell type of mixed tumor which does not show myxo-

matous or cartilaginous differentiation. Clinically the cylindromata closely resemble the mixed tumors in encapsulation extraglandular location, and in a relatively benign, slowly growing stage which may terminate in malignant activity with metastases (Tomasson Barozzi and Lesné). The typical history is of a small tumor mass which has been present for several years or since childhood which suddenly begins to grow more rapidly and invades the surrounding tissues. The first operation is frequently inadequate and is soon followed by recurrence. The early recognition of this type of growth and its proper radical treatment is urged by Brandes and by Adson. Both advise complete removal of the gland if there is reason to believe that the growth has extended through its capsule, and Adson and Ott describe a method of excision of the parotid with preservation of the facial nerve.

There are relatively few case reports of primary carcinomata of the salivary glands which can be clearly distinguished from carcinomata arising in mixed tumors. Of 267 tumors of the salivary glands reported by six authors (Wood, Nasse, Volkmann, Landsteiner, Kaufmann and Kuettners) 13 or 4.8 per cent were carcinomata. This percentage may be considered as only roughly approximate as many of the reported cases have but fragmentary clinical histories to

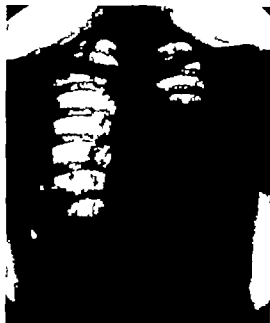


Fig. 3. Roentgenogram showing homogeneous density in lower two-thirds of left chest with obliteration of the pleurastatic shadow and contopluratic angle. Condition was thought to be pneumonia, process.

correlate with the confused pathological terminology. Other cases have been reported by Nasse, Tilton, Ehrlich, Speese, Fraser and Payne. Histological proof of the origin of the tumor from the acini of the gland is difficult and, although in a case reported as adenocarcinoma Doerr shows tumor lobules lying adjacent to normal glandular substance. Brandes remarks that to furnish certain proof the tumor cells must lie in the same acinus with normal cells. The tumors usually reproduce the acinar structure of the gland and may produce a mucoid secretion. There are commonly two types described, the acinar and medullary although Heineke believes most of the tumors described as medullary are malignant mixed tumors. The growth is usually very hard and fused with the gland and the cervical lymph nodes are invaded early. In further contrast to the malignant mixed tumors there are rarely metastases to internal organs. Delanglade attaches diagnostic importance to early facial paralysis. Pain is a frequent symptom.

#### CASE HISTORY

The case presented is that of an adenocarcinoma of the parotid region in which during the course of numerous recurrences the preponderance of cells which had undergone differentiation to the basal cell and hair matrix type caused confusion regarding the proper classification of the tumor and led ultimately to a lack of appreciation of the fundamentally malignant nature until it demonstrated itself by general metastases.

Mrs H. L., widow age 3, came to the Out Patient Department of the Massachusetts General Hospital on December 30, 1903 for swelling of year duration in front of the right ear. The lesion was described in the record as a discrete gland and noted as made of partial right facial paralysis. The patient did not return until 5 months later when she was referred to the surgical service.

March 25, 1900. The family history was negative for hereditary cancer. The past history included a left rhinoplastic oophorectomy with routine appendectomy for chronic salpingitis in 1904. The tumor in front of the right ear for which she entered as the size of a pigeon egg of firm elastic consistency and fixed to the underlying tissues. It was noted to have increased somewhat in size during the past year but recently had grown steadily larger and although it first it was freely movable it had been fixed for at least 8 months. At times it caused pruritus which she referred to the neck. There was absence of wrinkles on the right side of the forehead.

Operation, June 3, 1900. Dr. F. G. Balch. The tumor as found to be superficial to the parotid gland and removed entire in its capsule.

Pathological report. An oval infiltrated growth 4 by 2 centimeters with opaque slightly fibrous surface. Microscopical examination showed solid masses of epithelial cells infiltrating the tissue in all directions. Cancer (Dr. W. Whitney).

October 28, 1900. Five weeks after the operation the pruritus recommenced and gradually became more severe. Shortly after and the patient noted a swelling in the region of the scar which increased somewhat in size but gradually became larger.

In front of the right ear there was surgical scar 3 inches long, box hard nodular slightly movable plaque extending from the top of the ear to the angle of the jaw and forward 5 inches from the ear. There was distinct limitation of motion of the jaw bones but no adjacent glandular hypertrophy as noticeable.

Operation, November 8, 1900. Dr. C. A. Porter. Dissection was carried down to the great vessels of the neck. The glands were removed and the submandibular triangle was cleaned out. The space behind the angle of the jaw was cleaned as far as the mastoid process and up to the foramen ovale. The skin was incised close to the ear in front and



Fig 4. Locust of tumor free from recurrence, with scar

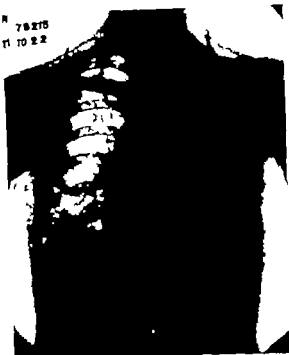


Fig 5. Roentgenogram showing dullness throughout the entire left chest including the apex

the tumor mass as removed. Stenosis did not was ligated. The carcinoma had extended so close to the jaw that further growth seemed almost certain.

*Pathological report (Fig 1).* A mass of new growth 5 centimeters diameter showing upon microscopical examination solid masses of large epithelial cells were evidently springing from the acini of the gland and infiltrating the tissue irregularly. Cancer (Dr W. Whitney).

On November 3 the patient was given her first treatment with X-ray. Facial paralysis was complete following the operation.

The clinical course and pathological findings at this time indicate that the tumor as an adenocarcinoma arising either from the acinar epithelium of the parotid gland, or from malignant change in an extraglandular mixed tumor. The original operative note which describes an encapsulated growth is suggestive of a tumor of extraglandular origin of the form frequently assumed by the so-called mixed tumor. The pathological description of the tumor removed at the second operation indicates an acinar origin for the cancer cells, this conclusion apparently being based on the proximity of tumor cells to normal parotid acini as is shown in Figure 1. This same finding is reported by Doerr and also by Brandes. The latter however as was stated above believes that it proves their origin from parotid tissue the tumor cells should be demon-

strated to exist in the same acinus with normal cells and not merely in adjacent lobules. The spontaneous facial paralysis and pain suggest a primary parotid growth, as does the relatively short duration of tumor and its pure glandular structure.

April 3, 1913. A year ago the patient noticed a swelling over the zygoma which has since increased in size. There is not much pain, but constant tenderness. The tumor is small, firm, immovable, and slightly tender.

*Operation.* April 24, 1913. Dr C. A. Porter. The tumor was found to involve the posterior portion of the zygoma and upper part of the ramus of the lower jaw extending down to the fascia of the temporal muscle but apparently not involving the skull. The tumor was excised with the posterior portion of the zygoma, the upper part of the ramus of the lower jaw including the entire joint a small part of the superior maxilla and the fascia of the temporal muscle.

*Pathological report (Fig 2).* A hard tumor mass the size of hen egg with smooth whit section surface from the parotid, on microscopical examination showed a mass of rather small epithelial cells in many pleomorphic lines in places with hyaline degeneration about them and with considerable atrophy of the cell columns. Cancer (Cylindroma) (Dr W. Whitney).

At this time 3 years after the original operation, we find noted the appearance of basal cell metaplasia

and the tumor is classified as a cyndroma although its malignant nature was keenly appreciated.

May 3, 1914 About 1 month ago the patient noted a small lump growing on the right ear which is now seen as a firm cherry sized tumor involving the tragus.

**Operation** May 23, 1914 Dr C. A. Porter The tumor was excised by a circular incision which passed across the auditory canal.

**Pathological report** Microscopical examination showed a lobulated growth of solid masses of epithelial cells in arrangement recalling that of a gland and separated by distinct bands of fibrous tissue. Sebaceous adenoma (Dr W. Whistler).

July 3, 1914 A small Thiersch graft from the thigh was placed to cover the defect of the previous operation.

Although the glandular structure was still noted, the basal cell differentiation was so complete at this time that the diagnosis of sebaceous adenoma was accorded this recurrence. From this time the true nature of the tumor gradually became obscured.

August 17, 1915 Later a small lump appeared in the right temporal region which is now seen as a small, hard nodule in the upper anterior portion of the ear.

**Operation** August 8, 1915 Dr R. B. Greenough Excision and cauterization of an epithelioma of the right temporal region.

**Pathological report** Macroscopic examination showed columns and groups of typical epithelial cells in stroma of connective tissue. The cells resembled the epithelial cells of the hair roots or cells of the basal layers of the epidermis. The tissue shows considerable necrosis. Carcinoma of basal cell type (Dr J. H. Wright).

July 8, 1916 About 1 month ago the patient noticed a small lump in front of the right ear which was now the size of a small bean.

**Operation** July 9, 1916 Dr C. A. Porter excised an epidermoid carcinoma of the face with Thiersch graft to the defect.

**Pathological report** A button shaped tumor the size of a cherry stone having a gray-white section surface on macroscopic examination showed irregular masses of undifferentiated cells infiltrating the corium and covered with stratified epithelium which showed the underlying papillary processes flattened out. Here and there were areas of round cell infiltration. This type of carcinoma is derived from the cells of the hair follicles. Epidermoid carcinoma (Dr H. F. Hartwell).

The typical story of a small recurrent nodule near the ear was repeated five more times and once the patient entered for removal of a sequestrum of the temporal bone. Excisions of the nodules were performed by Dr C. A. Porter. Pathological reports are as of July 8, 1916. Epidermoid carcinoma.

During these 6 years the tumor was classified both pathologically and clinically as an epidermoid carcinoma. Traces of the original acinar structure were obscured by the basal cell differentiation, and

the local recurrences were typical of a tenacious epithelioma. The tumor as judged at this time might have been either a mixed tumor of adenoid cystic epithelioma type or primary cutaneous epithelioma arising in the operative scar or as really was the case an adenocarcinoma arising either primarily in the gland or in a mixed tumor.

September 19, 1915 After leaving the hospital 2 years ago the patient was well for 7 months when she had an attack of pneumonia lasting 6 weeks. A year later she had a second attack of pneumonia of 6 weeks duration. She has not felt well since this last sickness and has lost 35 pounds. She has had recurrent colds since May 1921 with a small amount of blood tinged sputum. Pain in right axillary region was intensified by her "colds." Three months ago she noted a small lump back of the right ear which has grown somewhat larger.

The right parotid region shows thin white skin closely applied to the bones of the skull owing to absence of underlying tissues. The ear is involved in the cicatrix, and is fenestrated posteriorly. Just beneath the ear is a small, hard freely movable mass the size of a pea. There is complete right facial paralysis and numbness of the right side of the face throughout the distribution of the lower two divisions of the trigeminal nerve.

The chest examination showed dullness throughout the left chest posteriorly, more marked at the base. Breath sounds, tactile fremitus and voice sounds were diminished over this area. A riles were present. A medical consultant believed these signs to indicate thick pleura only and attributed the hemoptysis and colds to pharyngeal infection.

**Operation** September 29, 1921 Dr C. A. Porter. The lobe of the ear was excised with the nodule. The surface of the mastoid bone was removed with chisel and actual cautery.

**Pathological report** Microscopical examination of the larger nodule from the ear showed solid clusters and strands of undifferentiated epithelial cells with reactionary fibrosis. No cornified or prickly cells could be found. Mitotic figures were numerous. A section of the nodule from the mastoid region showed

similar tumor invasion. The appearances resembled carcinoma arising from hair roots (Dr H. F. Hartwell).

During her convalescence she experienced an exacerbation of pulmonary symptoms and was considered to have a pneumonic focus in the left lower lobe. An X-ray taken at this time (Fig. 3) showed homogeneous density in lower two thirds of left chest with obliteration of diaphragmatic shadows and costophrenic angle. The condition was thought to be a pneumonic process in the lung.

She was referred to the Huntington Hospital where radium seeds were implanted in the operative field.

In looking back at this entry one can clearly see pictured the onset of metastatic malignant disease of the lung. The nature of the process at this time was not recognized, as the signs and symptoms,

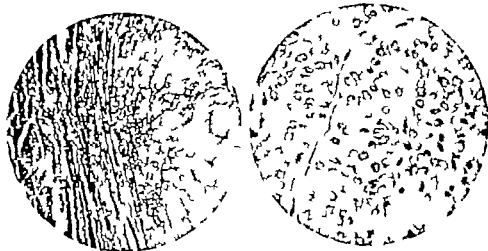


Fig. 6 (at left) Large, degenerate, atypical cells in fine vascular stroma metastatic carcinoma.  
Fig. 7 Columns of atypical epithelial cells invading the muscles and nerve sheaths, with areas of gland tubule formation. Numerous mitotic figures.

except perhaps the hemoptysis, were consistent with the two preceding attacks of pneumonia, and the tumor had now for several years been passing for simple basal cell carcinoma of hair matrix type which practically never shows pulmonary metastasis.

November 3, 1921 The patient has continued to have intermittent coughs with cough and blood tinged sputum. One week ago she began to experience severe pain in the left chest at the base of the lung. She has grown increasingly weak and has lost considerable weight.

Physical examination showed locus of tumor free from recurrence with scar as described September 19, 1921 (Fig. 4). The left chest scarcely moves on respiration, and is flat to percussion throughout with absent breath sounds, vocal and tactile fremitus except at the extreme apex. The fingers are somewhat clubbed.

The sputum was small in amount, bloody, mucoid, and contained no tubercle bacilli.

X-ray examination (Fig. 5) showed dullness throughout the entire left chest including the apex. The dullness is of even density throughout and in the prone position the heart and mediastinal contents were displaced to the right. In the erect posture there was little or no displacement of the mediastinum. The shadow of the ribs can be seen, but the outline of the diaphragm is obliterated. There is no evidence of pathology in the right chest. The appearance could be due to extensive malignant disease or to a very large amount of fluid (metastatic malignant disease of lung).

A medical consultant considered that the condition in the left chest was probably extensive pleural thickening dating to the pneumonia 3 years previously. The left apex as thought to show either atelectasis from compression or old fibrosis, or new growth. The cardiac displacement was not great.

The white count varied from 15,200 to 28,000 with 85 per cent polymorphonuclear neutrophils. The blood Wassermann was negative.

A chest tap was done on November 8 in the eighth interspace midscapular line. The needle met solid resistance and a small amount of blood and bloody fluid was obtained. No organisms were found in smear or culture. A few shreds of tissue were sent to the pathological laboratory.

**Pathological report** (Fig. 6) A small soft fragment removed at a pleural tap showed on microscopic examination sheets of large degenerate, atypical cells in a fine vascular stroma. Metastatic carcinoma. (Dr. H. F. Hartwell).

Although the diagnosis made by pleural tap was in all probability trustworthy there were many features about the case which led one to believe that the condition might be a chronic suppurative pleurisy. The irregular temperature, leucocytosis, history of previous pneumonia and unilateral nature of the lesion, in addition to the fact that a pulmonary metastasis of a basal cell carcinoma was an unknown occurrence made an exploratory thoracotomy seem advisable.

**Operation** November 21, 1922 Dr. Wyman Whittemore.

Under novocaine anesthesia a curved incision was made over the fifth rib in the anterior axillary line revealing a small nodule in the muscles of the chest wall. This was excised, and a two inch segment of the rib removed. The pleura looked opaque but the lung could be seen moving under it. It was firmly resistant, however, and at first glance gave the impression of a thickened pleura with adherent lung. The pleura was incised revealing a solid, grayish lung, small segment of which was removed for diagnosis.

**Pathological report** A spherical nodule from the muscles of the thorax, measuring 2.3 centimeters in



diameter showed a white, sticky, translucent surface on section.

A small piece of tumor was removed from the lung, and, as observed at operation the pleura did not appear thickened. The portion of the lung exposed seemed filled with white tumor showing translucent, sticky juice extruding from its cut surface.

Microscopic examination of the lung showed solid columns of atypical epithelial cells invading the walls of the alveoli. Occasional irregular gland tubules occurred in the centers of these cell columns.

A macroscopic examination of the nodule of the chest showed columns of typical epithelial cells invading the muscles and nerve sheaths. There were areas of gland tubule formation (Fig. 7). Mitotic figures were numerous in both specimens.

A review of all the sections from this case since 1909, shows carcinoma, the cells of which differ little mostly to the basal type, and occasionally to squamous epithelium.

Most of the sections show small gland tubules in the midst of the cell columns. These tubules are lined by epithelium, the cells of which have more deeply-stained cytoplasm than the surrounding epithelium forming the cell clusters. The tubules are often filled with mucus.

In general the cells become more typical in the latter recurrence and are relatively of greater abundance than the stroma. The histological character is consistent with a primary tumor of the parotid gland.

**Diagnosis.** Metastases of adenocarcinoma of parotid in lung and chest wall (Dr. H. F. Hartwell).

The convalescence was uneventful and she was referred to the Huntington Hospital where she was given deep X-ray therapy over the left chest. The first treatment was followed by severe hemorrhages but aside from this she experienced some relief from her dyspnea and cough. Her last visit to the Huntington Hospital was on June 20, 1923, at which time she appeared to be rapidly losing ground. An X-ray treatment was followed by hemorrhages so no further therapy was planned. The last report from the patient was on February 2, 1924, at which time her condition had not essentially changed.

#### SUMMARY OF HISTORY

The history given in detail above records the course of a tumor of the parotid the excision of which was followed by eleven recurrences with as many secondary operations during the past 14 years. The second operation included complete excision of the gland and removal of the cervical lymph nodes, the subsequent operations have been local excisions with or without cauterization. Radiation both by X rays and radium have been employed at intervals during the course

of the disease. At the end of 14½ years, two years after the last operation there is no evidence of local recurrence but the left lung shows extensive involvement by metastasis of the tumor.

During the course of the disease and the many re-entries to the hospital, microscopical studies of the recurrent nodules of the tumor have yielded various differing pathological diagnoses, viz. cancer cylindroma, sebaceous adenoma, basal cell carcinoma and epidermoid carcinoma of the hair matrix type. The tumor of the lung is recognized as metastatic adenocarcinoma.

In the records, the tumor has been classified clinically as carcinoma of the parotid, face, neck, ear and temporal region, as epithelioma and as a mixed tumor.

#### COMMENT

The confusion in both pathological and clinical diagnosis obviously arose from the tendency of an adenocarcinoma of the parotid to differentiate as a so-called cylindroma. The many recurrences show successively an increased tendency toward this basal cell metaplasia and a corresponding decrease in alveolar structure. The origin of the tumor is not entirely clear. The encapsulation of the growth noted at the original operation, the marked tendency toward basal cell metaplasia, the hyaline deposition in the stroma, the lack of lymphatic extension and final occurrence of metastasis by the blood stream and the long duration of the disease all suggest that the tumor is related to the group of mixed tumors. On the other hand, the acinar structure seen in the recurrences and predominating the metastases, the production of mucoid secretion, the relatively rapid growth of the tumor at the time of onset (1½ years) and the early pre-operative involvement of the facial nerve are in favor of a primary parotid carcinoma. We believe that the weight of evidence favors a classification as a malignant mixed tumor although a pre-existing quiescent stage cannot be demonstrated clinically or histologically.

As interesting features may be mentioned the completely unilateral distribution of the pulmonary metastasis, on the side opposite

of the tumor and the diagnosis of malignancy of the lung by the aspirating needle

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## CLINICAL OBSERVATIONS ON THE ETIOLOGY OF GALL STONES IN WOMEN

BY L. SCHRAGER, M.D. CHICAGO

THIS paper covers observations made over a period of 15 years, during which time I was able to verify many facts based upon clinical study and operative proof. The first case which came to my attention I saw in 1908. The patient was a young woman of 19 years, with an excellent health record up to the time of her first pregnancy. Four days after a normal delivery she exhibited a stormy syndrome closely resembling gall-stone colic. She had repeated typical attacks thereafter and finally 8 years later an exploratory laparotomy confirmed the original diagnosis of gall stones. Since treating this case I have seen similar conditions in very young women shortly before or after the first pregnancy.

The thesis I wish to advance is that cholecystitis in women, in a large number of cases, originates during the first pregnancy; that in many cases it passes unrecognized and that the gall stones of middle life very likely are the end product of cholecystitis originating during the first pregnancy.

Every clinician is familiar with the fact that cholecystitis occurs more frequently among women than among men and that there is a close relationship between pregnancy and the presence of gall stones. My reason for reopening this subject is that I believe statistics underrate the frequency of cholecystitis in women; that the statistics which establish the period of occurrence of gall stones in women are based upon operative and postmortem findings. Such information, however, does not establish the actual origin of the disease. I believe that the ratio of cholecystitis in women as compared with men which is given as four to one or five to one must be questioned. The etiological factor of cholecystitis persists so overwhelmingly in women, that one is at a loss to interpret the statistical data.

The first intimation of the relationship between pregnancy and cholecystitis was

made by Huchard in 1882 and Cyr in 1883. Dieulafoy, in 1898 laid great stress on this relationship and his views were supported by information gathered from the large obstetrical clinics of Tarnier and Pinard. Not only pregnancy but the entire sexual period of married woman and her mode of life seems to be closely interrelated to the development of cholecystitis. American literature has a great enthusiast in Reuben Petersen. He expresses surprise that the literature records so few gall stones during pregnancy and the puerperium, when the frequency of gall stones in women is borne in mind. Schauta and P. Muller deal with the subject in a few words; the matter receives meager consideration in the large work of Winkel's *Handbuch der Geburtshilfe*. In order to appreciate the evidence one must be permitted to review all the etiological factors of gall stones.

## INFECTIOUS FACTORS

Of all types of organisms, the typhoid bacillus is present most frequently. It is found in the gall bladder of patients who have or have had typhoid fever. Old calculi occasionally yield the organism from their nuclei. The same holds true of the organisms of the colon family. These facts have been proven conclusively by Futterer, Naunyn, Blachstein, Welch, Koch, Gay, Claypole and others. Clinically, however, one very seldom sees a case in which the typhoid etiology is present. It is no longer a clinical routine to ask a gall stone suspect whether he has had typhoid. We know now that typhoid is gradually disappearing whereas gall-stone cases are multiplying in number. Besides, various investigators have found that the sources and avenues of infection are so varied and so numerous that typhoid is rather an exceptional factor in the causation of cholecystitis. The liver and its appendages are indeed, a hub toward which infective material radiates from numerous sources. Infection

reach the liver the gall bladder and the ducts by way of the blood stream from a local source, or along the tributary vessels from a local abdominal source—the duodenum and small intestines for example. By emulsifying and culturing pathological gall bladders, R. O. Brown, under the guidance of C. Rosenow, found the streptococcus to be the chief agent of infection. The organism was obtained showed an elective affinity for the gall bladder of animals, and he concludes that cholecystitis is commonly a blood borne infection from a focal source. Some hold that infection can be carried by the hepatic artery (Branson). Adams contends that organisms, which are picked up by the leucocytes during the process of digestion are carried into the radicals of the portal vein. J. Earl Elze does not share this view. Crook believes that organisms may travel through the thoracic duct by way of the lacteals. Branson, Elze and others think that the infection may start in the duodenum and then progress along the common or cystic duct. This possibility can scarcely be accepted on account of the sterility of the duodenal contents and the resistance of the common duct to the entrance of duodenal material. Personally I have been impressed by the frequency with which gall-bladder disease is associated with some definite pelvic pathology a fact which has been observed by good many other clinicians. In the course of routine palpation of gall bladders in a series of 542 laparotomies, Reuben Petersen found that 64 or 11.8 per cent, had gall stones of these 48 or 75 per cent, had borne children. Some of these patients came to the operating table chiefly for gynecological reasons. Kelly intimates that puerperal infections may be an etiological factor of gall stones. In several experiments, I have attempted to ascertain whether or not organisms from pelvic infections may reach the gall bladder either by direct extension or by an affinity for the gall bladder in the sense of Rosenow's views. The cultures for these experiments were obtained from severe cases of puerperal sepsis, and they killed the animal so rapidly that it left no room for any conclusion. However if one may have the privi-

lege of speculating, I should like to advance the view that it is possible that certain strains of organisms from pelvic infections may have the same affinity for the gall bladder as Rosenow's streptococcus has for the same organ. There is room and opportunity for experimentation in that direction.

Whatever the source or type of the infection may be bile is usually sterile when its flow is unhampered. Pregnancy crowding the intestines against the biliary passages occasionally kinking or obstructing them coupled with the slowing of diaphragmatic excursion is conducive to stasis. This phenomenon interferes with the physiological rate of expulsion of bile, which favors bacterial invasion and growth.

#### CHEMICAL FACTORS

What was vaguely considered gall-stone diathesis by Dieulafoy and others is according to Schade (1910) and Riedel (1912) a hypercholesterinemia. Cholesterol is kept in solution as long as bile flows at regular physiological intervals. Stagnant bile throws cholesterol out of solution and it precipitates in the presence of bacteria. The cholesterol content of the blood in pregnancy increases with the progress of pregnancy drops in the first few days after delivery increases again thereafter and becomes normal after 2 months. The clinical facts correspond exactly to these chemical variations. Before I became familiar with these biochemical changes in pregnancy I observed that dyspeptic symptoms are more common in the latter period of pregnancy (sixth to the eighth month) and that these symptoms, or actual attacks recur shortly after delivery. In other words, there is a strong parallelism between the physiological facts and the clinical course of cholecystitis antepartum and postpartum. Hypercholesterinemia of old people may explain, in part, the frequency of gall stones occurring in both men and women in advanced ages.

#### MECHANICAL FACTORS

Among the mechanical factors which, directly or indirectly contribute to gall-bladder pathology are the following: A large uterus

and abdominal tumors, especially fibroids, interfering with the emptying of the gall bladder either by increasing the intra-abdominal pressure or by hindering the diaphragmatic excursion. Reuben Petersen states. It is significant that in one-third of the patients the onset of the attack is at the period of gestation when the uterus is approaching the level of the umbilicus when as an abdominal organ it is beginning to crowd the uterus toward or upon the bile passages. In a series of fifty cases of gall stones Mosher found that 13 or 22.4 per cent had fibroids. In a group of 1,232 operations for uterine fibroids at the Mayo Clinic, 92 or 7.1 per cent, had gall stones. Myake ascribes the scarcity of gall stones among Japanese women to the fact they they do not wear corsets. Lateral curvature plays a great rôle in the formation of gall stones. In his *Anatomy of Glendard's Disease* Keith mentions that gall stones are almost invariably present in this condition.

#### PHYSIOLOGICAL FACTORS

There is an actual physiological upheaval in pregnancy. As stated by the Mayos, the liver of man is one-thirty-sixth of the body weight while the liver of woman is one-fortieth of the body weight, which implies, in a measure that the liver of woman is less active functionally. Since the liver of pregnant women functions for both mother and child and has to labor with its own as well as fetal metabolism it is necessarily overtaxed physiologically and has a diminished resistance to infection. Branson makes a similar implication and emphasizes the rapidity with which this overtaxation takes place. Goldsborough and Alnley have shown that the power of eliminating toxic material is below par in the latter months of pregnancy. Actual liver changes occur during pregnancy as testified by the great frequency with which jaundice occurs during cholecystitis of pregnancy.

The inefficient contractions of the diaphragm as well as those of the abdominal muscles, tend to slow the current of bile which invites precipitation and bacterial invasion. Both men and women who live on a liberal fat and albuminous diet may show a

cholesterin diathesis which favor the production of gall stones.

#### MISCELLANEOUS FACTORS

Branson suggests that the various psychical phenomena during pregnancy affect the liver as they affect the thyroid gland. One must readily accept the fact that the anticipation of the hardships, and the suspense of the long period of pregnancy are capable of disturbing women psychically.

In addition to the above factors the sedentary mode of life and particularly constipation, which is far in excess of that in men also predispose women to cholecystitis.

If all the factors mentioned occur with definite constancy in women, we should be able to record more cases of cholecystitis among women and a great many more as compared with men. These factors also suggest that if there is any relation between them and the causation of gall stones, they must necessarily occur in a large measure, during the first pregnancy. While the subsequent pregnancies may also show all these tendencies, it is fair to assume that woman has developed a sort of an adaptation to all these disturbing factors which does not exist during the first pregnancy.

It is incumbent upon the clinical historian whether medical student, interne, or clinician to go into the most minute details of the sexual life of women especially during the first pregnancy and record all the discomforts or actual attack of abdominal pain, as they may have a bearing upon the ultimate diagnosis in the case. It is very seldom that the upper abdominal symptoms occurring during pregnancy are properly estimated, because they do not assume the character of a frank attack especially when occurring in very young women. There still are many physicians who cling to the old idea that gall stones is a disease of middle or advanced life. My experience is quite the contrary. I have seen quite a large number of cases of cholecystitis occurring in patients below the age of 30 and I have been able to follow many cases from the original cholecystitis of early life to the clean-cut picture of gall stones exhibited in middle life. True enough, the clinical picture

of cholecystitis occurring during the first pregnancy is not clean-cut and may manifest itself either in the form of vague dyspeptic symptoms or it may assume the character of a genuine colic. It may be confused with other stormy yet transient clinical pictures which occur during the latter months of pregnancy or postpartum such as intestinal colic, colitis mucosa, after pains puerperal sepsis appendicitis, pyelitis, etc. Branson speculates that the usual symptoms which accompany early pregnancy such as morning sickness, water brash sour stomach, and nausea may be of hepatic origin. It was indeed a revelation to clinical medicine when Moynihan called the attention of the profession to the fact that the dyspeptic train of symptoms is the first indication of gall bladder pathology. In the case of Rose the gall bladder ruptured during the second stage of labor. Sudden pain, shock, and collapse are present in both conditions and it is both logical and excusable to suspect rupture of the uterus. The presence of chills, fever and abdominal pain following delivery may suggest sepsis. This was the case in a patient of Pinard in which a forceps delivery was followed on the third day by such symptoms which masked an acute gall bladder upon which operation was delayed until the tenth day. A case of Vineberg in which general abdominal sepsis was suspected, proved to be a ruptured gall bladder.

Instead of burdening the reader with a complicated tabulation of cases, may I be permitted to give a composite picture of the cholecystitis of the first pregnancy as I have seen it in most cases? The patient is usually a young woman between the ages of 18 and 25 with a previous clean bill of health. She marries and becomes pregnant within a few months after marriage. She gains in weight rapidly adding 15 to 25 pounds. During the seventh month of pregnancy occasionally as early as the fifth but most commonly during the seventh and the eighth month, she complains of a vague abdominal distress either in the epigastric region or in the right hypochondrium lasting from a few minutes to 1 hour. Occasionally she has a genuine colic. It is quite unusual to have these attacks occur during the actual delivery

although I have seen several such cases. Between the third and seventh day postpartum these attacks may recur. My experience has convinced me that in some cases the attack is of such short duration that the attending physician does not have a fair chance to witness it. The nurses and the internes either make light of it, or they fail to grasp its significance. It is a common occurrence to charge these spells to indiscretion of diet, too many visitors, and what not. The patients leave the hospital and continue to have such spells at home. In about half of the cases the attacks abate and to all practical purposes disappear for the time being. Very few come to operation within the first 3 months after delivery because it is hard to convince not only the patient but frequently the attending physician himself that the young woman has gall stones. In the remainder of the cases these young women come to operation between the ages of 25 and 30 after they have undergone various types of non-operative procedures.

I have operated in several cases very shortly after delivery and I have found that in a few cases the gall bladder contained either a putty-like mass or a fair number of very small concretions. There is a group of patients who invariably yield a single date-like stone tightly impacted in the cystic duct. The attack is violent with localization in the right hypochondrium, and distressing respiratory embarrassment.

#### CONCLUSIONS

Cholecystitis of middle adult life in women, in a large number of cases, traces its origin to the first pregnancy and as such it must be recognized as a distinct clinical entity. If this conclusion is supported by observations of other clinicians, it may tend to destroy the clinical superstition that young women do not have gall stones. It may train the medical student, the interne, and the general practitioner to link the vague abdominal phenomena occurring during the first pregnancy and recurring during the subsequent pregnancies with the clinical finality of the gall stone picture present in patients between the ages of 35 and 45 years.

## THE INDICATIONS AND RESULTS OF THE INTERPOSITION OPERATION IN THE TREATMENT OF CYSTOCELE AND PROLAPSE OF THE UTERUS<sup>1</sup>

B. C. JEFF MILLER, M.D. F.A.C.S. NEW ORLEANS

Professor of Obstetrics and Clinical Gynecology Tulane University School of Medicine

**T**HAT the numerous operations devised for the correction of prolapse of the uterus and cystocele are unsatisfactory is proved by the high percentage of recurrences following their performance. Many of them are based on ingenious and elaborate denudations or complicated applications of sutures, and though some notably the Hegar Stoltz, and Alexander operations, gave good primary results, as do the other plastic procedures the end-results of none are entirely satisfactory. The reason for their failure is not far to seek. They do not take into consideration the anatomical relations of the pelvic fascia, with the underlying causes of the injuries they seek to correct, and they fail to appreciate that prolapse of the uterus and cystocele are nothing more than herniae through the pelvic canal.

In order to understand the pathology of uterine prolapse and cystocele, it might be well to compare the relations of the pelvic canal with those of the inguinal canal. The inguinal canal leaves the body obliquely and is protected largely by internal pressure outward against the abdominal wall. Any structure passing through this canal must pass obliquely and must be subjected to the natural physical and anatomical factors that protect the openings of the body. These same considerations hold true in the study of the pelvic organs. The vaginal canal is similarly protected and leaves the body in an oblique or curved direction. The strong fascial sheets under the bladder which we usually term the vaginal plate connect with the structures at the base of the broad ligaments and intra-abdominal pressure is exerted behind the symphysis pubis and has a tendency to act on the uterus, or more correctly the fundus of the uterus, and throw it forward on the bladder. Structures leaving the abdomen by the vaginal canal therefore must pass behind

this anterior vaginal plate, but when it has been injured by the trauma incident to labor the canal is practically straightened out and descensus of the organs is the natural consequence.

Cystocele occurs by reason of injury to the anterior vaginal plate and the bladder gradually sags because of the retracted fascia. Cystocele therefore is nothing more than a hernia and any operation for its correction to be successful, must either restore the fascia underlying the bladder or must fill in the opening by some structure that will provide a firm base upon which the bladder may rest. The injury of this plate together with an injury of the strong fascia covering the levator ani muscle causes an associated condition of rectocele, though it must be borne in mind that prolapse of the uterus and cystocele are not necessarily associated with perineal tears.

These conditions may occur in nulliparous women, but they are due in such cases to developmental errors and present individual problems that may be disregarded for the purposes of this paper. They most frequently follow the injudicious use of forceps before the cervix is fully dilated. The cervix is then stripped away from its fascial attachments and the entire fascial planes of the pelvis are thereby weakened and attenuated. A similar condition may arise however when the patient has not been delivered by forceps, but in every such case a history of tedious, protracted labor will be elicited in many instances with an unusually large child.

It is evident from these facts that any operation for the correction of prolapse of the uterus and cystocele must be based upon the idea that the chief support of the pelvic viscera is the ligamentous attachments. This has been repeatedly proven by the failures that follow the various suspension operations, and

ven the firm fixation of the fundus of the uterus to the abdominal wall by various operative procedures. Prior to the development of the Watkins operation or as it is more commonly known the interposition operation no surgical procedure was entirely satisfactory for the relief of cystocele and prolapse. Even vaginal hysterectomy failed because while it eliminated one source of trouble the prolapsed uterus it failed to correct either the cystocele or the rectocele, and many cases ended in an even greater degree of rectal and vesical sacculation.

The Watkins operation has been in use since 1898 long enough therefore to study the end results of large series of cases and it is commonly agreed that it is the ideal procedure in selected types. Its results are more uniformly successful than those of any other operation devised for the cure of these conditions and it does not present the difficulties encountered in many of the other procedures, notably that of Goffe which was objectionable largely because of the extensive dissection and trauma to which the bladder was subjected. The details of this operation are so well known and its technique is so standardized that it is not necessary to elaborate either of these points, but it might be well to point out again the cardinal principles upon which it is based.

1. The bladder rests upon and is supported by the posterior wall of the uterus.
2. The uterus is elevated in the pelvis by being tipped forward its position being changed about 180 degrees.
3. The twist produced in the broad ligaments by the change in the position of the uterus perceptibly shortens them, and is the chief factor in correcting the uterine prolapse.
4. The tendencies of the uterus and bladder are antagonistic to further prolapse as they work against each other to hold the correct position.

It can be seen from this that the most important point of the operation is the relief of the cystocele the bladder being usually the only organ the function of which need be considered at the age at which the operation is most frequently performed but that in its correction the prolapse of the uterus is also

corrected by the change in its position. The basis of the operation is the utilization of fixed structures for support, and it not only avoids the removal of a uterus that is not pathological in itself but employs it as a plug for the hernial opening and a shelf as it were to hold the bladder in place.

The same care must be exercised in the selection of cases for the interposition operation as in any other operative procedure. It is by no means possible to correct all degrees and types of prolapse by this method and certain considerations must govern our choice of cases particularly the cleavage plane of descent, the size and condition of the uterus and cervix the degree of prolapse of the vaginal walls, the age and social condition of the patient, as well as the general abdominal condition and the presence of a visceroptosis. One case may present a hernia through the vesical plane of the fascia, with cystocele as the chief feature, in another the descent may have occurred through the postpubic plane and still another may be due to lacerations through the rectovaginal sheet, with rectocele as the main condition. Many authorities do not believe that the operation is of value when the prolapse has occurred largely through the rupture of the rectovaginal fascia, but this is contrary to my own experience, for in many cases I have combined the operation with a repair of the rectovaginal structures, with complete success. Some cases in my series which presented a picture of procidentia with practically complete inversion of the vaginal walls were permanently relieved by the combined operation. Such cases, however are the exception, and usually when complete procidentia exists, it is better unless the patient refuses hysterectomy as happened in two of my cases, to resort to the Mayo operation vaginal hysterectomy with the utilization of the base of the broad ligaments for supportive structures.

The size of the uterus and its condition are other points to be carefully considered. The hypertrophied uterus so common in long standing displacements, cannot be successfully utilized as a support for the bladder, but the size may be greatly reduced by a high amputation of the cervix, which is indicated



in all cases where the cervix is hypertrophied or elongated, or protruding through the vaginal orifice. This procedure also makes it possible to include in the sutures at the side of the uterus the fascia which has been stripped loose. A partial resection of the uterus is also possible. It is bisected laterally the mucosa being thoroughly removed, and the posterior half used for the reconstruction of the anterior vaginal plate. In a few instances I have even done a supravaginal hysterectomy removing possibly two-thirds of the fundus by a wedge-shaped incision, and leaving just enough to fill in the desired space under the bladder.

The age and social condition of the patient are also important points. The operation is never applicable to women in the childbearing period, unless there are special indications for its performance and the patient will consent to sterilization. Resection of the tubes should be done and the stumps carefully buried. Unless this precaution is taken, distressing complications may arise should a subsequent pregnancy occur. If the patient will not consent to sterilization, temporizing measures, or possibly some of the other operative procedures the success of which is questionable must be adopted. The interposition operation is especially indicated in women near or past the menopause, at which age the conditions most commonly arise, who present a small uterus, with the cervix hypertrophied and a cystocele the prominent feature.

The operation should always be combined with a repair of the perineal floor otherwise there is a tendency for the uterus to rotate on its axis and prolapse will recur. If the broad ligaments are unusually long, the bases should be cut away from the sides of the cervix and sutured together in front, in order to readjust the normal relations of the cervix to the posterior vaginal wall. This is superior to shortening the uterosacral ligaments because they are usually very much attenuated in cases of long standing prolapse and the operation necessitates opening the posterior vaginal vault. Other abdominal and vaginal conditions may be corrected at the same time.

In the early cases in which I performed this operation the morbidity encountered was due

to errors in judgment and to a faulty selection of cases but experience has corrected this to a large extent. Vesical disturbances occasionally occurred because of the incorrect coaptation of the structures and the suturing of the fundus of the uterus too far forward under the symphysis. Urethral disturbances followed, and an occasional vesical complication which was sometimes rather difficult to control. Imperfect haemostasis is a potent factor in producing postoperative complications, and can be overcome by various simple measures such as employing blunt dissection with scissors, etc. Cystitis occurred more frequently in the early cases than in the later series because it was then considered necessary to make a wide separation of the bladder somewhat as in the Goffe operation this has since been abandoned and bladder complications are now largely eliminated.

My experience with this operation is based upon approximately 80 cases in private practice, and a fair number in a large gynecological service in a public clinic. Of these, 50 consecutive private cases covering the last 10 years have been analyzed for this paper. During the period, 1913-1923 at least twice as many cases of cystocele and uterine prolapse were treated by other methods, an indication that the interposition operation does not suit every case in which these conditions occur. Two patients were 33 years old. Each gave a history of several tedious instrumental deliveries, each was very stout and had extensive lacerations of the pelvic floor. One had a very large cystocele, the other had a large umbilical hernia, a bladder diverticulum, and an almost complete prolapse. Both were suffering extreme pelvic discomfort, and the only alternatives were hysterectomy which was emphatically refused in both cases, or the interposition operation with sterilization. The age of the other patients varied from 40 to 73. Three were over 70 and the majority were between 45 and 55. Thirty had passed the menopause and 10 others were having menopausal symptoms. In the patients over 70 the operation was performed because of the aggravated bladder symptoms. Formerly in patients of this age, if operation was advised or performed the Stoltz operation was selected,

high consisted of the denudation of an area on the anterior vaginal wall and the use of a purse-string suture. The result was rarely satisfactory because of the recurrence of the cystocele. The interposition operation can be performed in these cases under local anesthesia if indicated with surprisingly little discomfort and uniformly good results.

The question of previous pregnancies is interesting. All of the patients in this series had borne children, the number varying from one patient with one previous pregnancy to one patient with sixteen. The abortions and miscarriages ranged from one in seven patients to seven in one patient. It is interesting to note that in more than 50 per cent of the series there was a history of one or more tedious forceps deliveries. Nine patients had complete procidentia of the uterus, 17 had hernia of probably one third to one half of the bladder capacity, all had vesical symptoms of some sort, and 5 had almost complete incontinence. Six had had previous unsuccessful plasties from 3 to 20 years before this operation was performed. Two of the operations were done under local anesthesia, and all were followed by perineorrhaphies. Sterilization was done in every case in which there was a possibility of subsequent conception. Myomectomy was done in 3 cases, umbilical herniotomy in 1, femoral herniotomy in 5, lipectomy in 3, hemorrhoidectomy in 10, amputation of the cervix in 24, supravaginal hysterectomy in 2, and salpingo-oophorectomy in 1. One case was given an application of radium, hysterectomy being advised and refused.

There was one death, occurring in a patient 33 years old whose condition was previously described. An amputation of the cervix was

done anterior and posterior colporrhaphy an umbilical herniotomy, lipectomy and sterilization, in addition to the interposition operation. She developed postoperative pneumonia and died suddenly on the twentieth day. The wounds were in good condition and there was no evidence of infection. One patient developed a left thrombophlebitis 3 weeks after operation, the others made uneventful recoveries.

Thirty nine of these 50 patients, 78 per cent, have been followed up from 1 to 10 years after operation. Thirty-six, or 93 per cent, report excellent health and complete relief of symptoms. Of the other three, one reports recurrent incontinence after 5 years of complete relief. She was 68 at the time of operation. One reports occasional incontinence after a shock or jar. The third was examined one year after operation, at which time the anatomical cure was perfect, but there was some frequency of urination. She later consulted a genito-urinary specialist, who reports a negative cystoscopic examination and some recurrence of the cystocele. Because of the strong neurotic element in the case he advises against any further surgery. Unfortunately none of these three cases has been examined personally and therefore no reason can be given for the poor results.

Finally in view of the excellent results obtained, ranging from 90 to 95 per cent of cures, it is natural to conclude that the interposition operation combined with the correctly applied principles of plastic surgery of the pelvis will result in a higher percentage of satisfactory results than any other operation so far devised for the relief of uterine prolapse and associated cystocele.

## SYMPOSIUM ON HÆMORRHAGE

HÆMORRHAGE<sup>1</sup>

By G. N. STEWART, M. D., CLEVELAND

From the R. K. Cook Laboratory of Experimental Medicine

WHEN I was honored with an invitation to participate in this discussion I readily accepted it, for hæmorrhage is a subject as practically important to the experimental pathologist and physiologist as to the surgeon. Most of your operations and nearly all of ours entail the loss of some blood. But while your patients often have a stock of 4 or 5 liters and may lose a few scores of cubic centimeters with impunity some of our subjects may not possess a total stock of 30 cubic centimeters, and cannot lose many drops without detriment. And if we are trying to determine the effects produced upon an animal by such an operation let us say as the removal of the adrenals we must be quite certain that the results, whatever they may be, have not been essentially influenced by the operative conditions, including hæmorrhage. Furthermore the influence upon the various functions of the body of such considerable hæmorrhages as are in themselves of surgical importance and the remedial measures necessary to cope with them have been studied not only by surgeons, but as often and sometimes in greater detail by physiologists.

Some hæmorrhages may produce exceedingly important consequences and be accompanied by striking symptoms when the quantity of blood withdrawn from the circulation is so trifling that in itself the loss would cause no noticeable effects. Such are hæmorrhages into the brain or cord or into the pericardial sac. Here the gravity of the symptoms depends not upon the amount of blood lost but upon interference with important structures. It is the seat of the bleeding not its amount which determines its effects.

When a substantial but not an immoderate hæmorrhage is caused, till the loss of blood is perhaps 2 per cent of the body weight, it is seen that a number of compensating changes occur which maintain the arterial blood

pressure practically at its initial level. A rather general vasoconstriction is brought about through the vasomotor center. The heart beats faster owing to the diminution of the tonus of the cardio-inhibitory center. For some little time the return of blood to the right heart by the veins is not diminished and the filling of the ventricles and therefore, their output not interfered with. This is due to the reduction in the capacity of the vascular system associated with the action of the vasomotors, the shrinking of the arteries, the partial emptying of the so-called venous distensibles, and the constriction, perhaps the temporary obliteration of some of the venules and capillaries, both those through which an active circulation has been going on and those in which blood has been stagnating. An additional compensatory mechanism is the increase in the respiratory movements, which aids the venous return of blood to the heart.

To some extent the loss of blood is made up for by the entrance of fluid into the vascular system from the circulating and tissue lymph. Although this begins early during or after hæmorrhage it is a relatively slow process in comparison with the rapid adjustments brought about by the other factors mentioned. The possible influence of a redistribution of the water in the blood between the corpuscles and the plasma upon the circulatory condition especially the viscosity of the blood apart from the influence of an actual reflux from the lymph, must not be overlooked although it is probable that it could not be more than a minor factor.

It is obvious that when the loss of blood reaches a certain point the compensatory mechanisms will no longer suffice to maintain the filling of the heart, and the quantity of blood ejected per unit of time from the ventricles must decline (Meek and Eyster, 10; Burton Optiz, 3 et al.) The changes

have been followed in detail by a number of observers especially by Wiggers (15). But the ultimate result is that the arterial blood pressure and what is after all the important thing the rate of blood flow through the organs is diminished by the falling off in the cardiac output, even in the case of those organs the blood flow of which has been previously cut down by vasoconstriction. The circulation through the brain begins to suffer especially since it is closely dependent upon the maintenance of the general arterial blood pressure.

When the amount of blood lost is increased to as much as 4 per cent or more of the body weight, anything like adequate compensation even for a brief time, by the mechanisms described becomes impossible. The vaso-motor center becomes paralyzed. The blood pressure falls to a low level (40 or even 30 mm. of mercury) and the blood flow is markedly decreased. The rapidity of the hemorrhage scarcely influences the level to which the pressure falls. This depends above all upon proportion of the total blood lost (Pilcher and Sollman 12, Downs, 5, Zinn and Govaerts 16). As might be expected the proportion of the blood which must be withdrawn to establish a given low blood pressure varies considerably in different individuals.

It should be pointed out that as regards the acute consequences of hemorrhage the loss of erythrocytes and not the loss of plasma is the important thing. This has been emphasized by Bert (2), Henderson (9) and others. More immediately important than the volume of blood circulating per minute is the mass of hæmoglobin circulating per minute. In the long run of course, the plasma is essential for the proper nourishment of the tissues. But any decided interference with the transportation of oxygen (and in a smaller degree of carbon dioxide) due to the loss of the red corpuscles is reflected at once in an interference with the gaseous exchange of the organs. In the case of certain tissues especially the nerve centers, the symptoms are marked and immediate and most of the compensatory mechanisms referred to above are brought into action in response to changes in the nervous centers, due to interference

with their internal respiration. Practically no stores of available oxygen exist in the tissues comparable to the stores of nutriment represented by the glycogen certain of the constituents of the tissue lymph and perhaps certain constituents of the tissue substance itself. So far as internal respiration is concerned evolution in the mammal has chosen uncompromisingly the hand to mouth plan in which by means of a highly efficient transportation system (the blood circulation) the oxygen required at the moment is delivered at the moment, with next to no provision for a breakdown in the transporting mechanism.

If the real functional lesion in hæmorrhage is interference with tissue nutrition and especially with tissue respiration as it certainly is. It becomes self evident that it is impossible to limit one's view to the circulatory changes alone. It is hardly to be supposed that any body who has thought seriously upon the matter has ever stopped at the fall of blood pressure or the diminished output of the heart or the diminished blood flow through the organs, without envisaging the consequences to the tissues of such interference with their blood supply. The more or less complete local asphyxia producing very rapid effects the more or less complete deprivation of nutriment producing effects more gradual but yet inevitable. That would be like saying that in the war the damage caused to the Allies and especially to England by the German submarines was that they sank the ships, and that the loss of the cargoes and of the other cargoes which those ships would have carried had they remained afloat and the consequent threat to the food supply of the nation and to its proper munitionment were of no importance. It was because of the loss of the things which the ships carried and the possible complete demoralization of the transportation system of England upon the seas, leading to her starvation as regards food and essential materials for the prosecution of the war that the submarine menace became so real. And when it is said that to the circulatory conception of hæmorrhage must be added a respiratory conception, it is something like saying that it was not only

ships which the submarines sank, but ships carrying cargoes or capable of carrying them. Nevertheless, it is by no means unnecessary or unimportant to insist, as among others Bert (2) and recently Henderson and Haggard (9) have done that respiratory effects must and do result from the circulatory changes and to endeavor to unravel some of these effects. Henderson and Haggard point out that the symptoms and processes observable in a partially exsanguinated animal are identical in many essential features with those under progressive deprivation of oxygen and with those occurring in carbon monoxide asphyxia. They are like those occurring in the process of acclimatization to great altitudes. They produced a "standard hemorrhage" (0.25 per cent of the body weight each 5 minutes during a period of from 1 to 2 hours) which caused the blood pressure to fall to about 38 mm of mercury. If the animal (dog) was then left to itself the chances were about equal that it would die or recover spontaneously. Transfusion of artificial solutions not containing erythrocytes was of little permanent benefit in comparison with blood. A marked decrease in the carbon dioxide content and of the alkali reserve was found to coincide with the increased pulmonary ventilation. Other observers (Genell & Tatum 14) have also found a decline in the alkaline reserve capacity of the blood in hemorrhage. This might indicate that the transfusion of an alkaline solution like sodium bicarbonate would be much superior to a simple sodium chloride solution after hemorrhage. Forty years ago Hayem (8) found that the latter was of little avail after a hemorrhage so severe that the animal would die if left to itself whereas it could be restored by blood. Some observers have stated that sodium carbonate is not much, if at all, more successful others (Dawson, 4 Henderson and Haggard 9) accord it a somewhat higher place.

Concerning the merits of the gum acacia solution introduced by Bayliss there is much diversity of opinion. It has not won great favor among surgeons in America. Some laboratory workers state that it is not demonstrably superior to salt solution. For example, Penfield (11) in Howell's laboratory

failed to show that gum sodium bicarbonate solution or gum glucose solution was more efficacious in saving life than was an isotonic solution of sodium chloride. Erlanger and Gasser (6), on the other hand report distinctly beneficial results from gum solutions in shock. If they are free from danger when properly prepared as claimed by their sponsors they possess the theoretical advantage over simple salt solutions that the colloid remains longer in the blood and aids in retaining the water. The value of the greater viscosity of the gum solution has been over-emphasized (13). If this factor favors an increase in the blood pressure it does so of course by making the blood flow through the tissues more difficult, and therefore slowing the flow unless the work of the heart is correspondingly increased. It cannot be assumed without proof that increase in the blood pressure is of advantage unless it carries with it an increase in the blood flow which is the important thing for the nutrition of the tissues. With a given amount of work by the heart the rate of blood flow will be greater when the viscosity of the blood is less. Bayliss (1) has since admitted that he does not consider the higher viscosity of the gum solution an advantage. Some authors speak of such factors as increased vasoconstriction compensating for the diminished viscosity of the blood due to the increased proportion of the plasma after hemorrhage. The diminution in the viscosity which according to Opitz (3) develops more gradually than has been generally supposed might rather be considered as compensating in some degree for the increased peripheral resistance due to the vasoconstriction and for the diminution in the venous return and the resulting diminution in the cardiac output. When blood is supplied by transfusion it is true that the liquid injected has a high viscosity. But that is not the reason for its unrivalled superiority to every other liquid. Its great virtue is that it supplies erythrocytes to the depleted circulation to carry oxygen to the tissues. It is the erythrocytes which are the principal factor in the high viscosity of blood. They are hard to drive through the capillaries. It is not because they are hard to drive that they

are valuable but rather in spite of it. It is worth while for the heart to force viscous blood through the tissues, because it constitutes the great transportation agency of the body. But it does not follow that it is worth while for the heart to force viscous gum through the tissues in lieu of blood.

In conclusion it may again be pointed out that a complete study of the effects of hæmorrhage must include not only the changes in the circulation, not only the changes in the mechanism and the chemistry of respiration, but all the physicochemical and even anatomical alterations of the various tissues with their accompanying functional derangements. From this point of view it is the nervous system which is most important, because it is generally the nervous system which fails first, and whose serious failure is most irretrievable. While the period during which medical or surgical intervention holds out any hope in a grave and rapidly developing ischaemia of the central nervous system may often be measured by minutes, a period of hours may pass for some of the less susceptible tissues. It must nevertheless, not be forgotten that renewal of an efficient circulation of good blood during this period may produce the most decisive effects. The question may also be asked whether if we knew more of the actual changes in the tissues

caused by loss of blood, we might not sometimes be able by special measures even to raise a submerged center which could not be restored by transfusion of blood alone to the level at which renewal of an efficient circulation would completely resuscitate it. All studies of transfusion are at the same time studies on hæmorrhage just as experiments on resuscitation are also experiments on normal function. For to know how the key acts when it unlocks the door is to learn something of how it acts when it unlocks it.

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HEMORRHAGE FROM THE STOMACH<sup>1</sup>

By ARTHUR DEAN BEVAN M.D. F.A.C.S. CHICAGO

Head of Surgical Department, Rush Medical College Head of Surgical Department and Attending Surgeon, Presbyterian Hospital

**H**EMORRHAGE from the stomach is a serious problem for the practitioner of medicine. It is important for us to carry to the bedside a working knowledge of the causes which produce it, the clinical evidence by which we may recognize the various pathological processes responsible for its occurrence and an accurate evaluation of the medical and surgical therapy which has been evolved up to this time so that we can give the patient suffering from such an accident the benefit of the best treatment that modern medicine affords.

It is, as a rule, not difficult to establish the fact that a patient has hemorrhage from the stomach from the fact that he vomits up blood and by excluding such conditions as bleeding from the mouth and nose and pharynx and the respiratory tract by careful history and examination. We must also exclude cases of hysteria where an effort to simulate vomiting of blood is sometimes made. There are also some cases of stomach hemorrhage which are not associated with the vomiting of blood but in which the blood is all either retained in the stomach or forced into the intestines. Some of these cases are fatal the patient dying in shock with the picture of internal hemorrhage and the cause of the condition not recognized clinically but found at the postmortem examination.

There are a large number of pathological processes which may produce hemorrhage from the stomach. Some of these are rare. I shall tonight in the limited time assigned to me discuss the common and usual forms which we must consider in making a differential diagnosis at the bedside. These causes are a, peptic ulcer—gastric, duodenal b, jejunal c, carcinoma of the stomach and other neoplasms of the stomach c, cirrhosis of the liver d, diseases of the spleen, especially splenic aneurysm e, jaundice f, hemophilia g, postoperative bleeding and h, hemorrhage from the stomach in the newborn.

Peptic ulcer is the most common cause of gastric hemorrhage. The hemorrhage may occur as a massive hemorrhage or as a chronic recurring hemorrhage which may eventually produce profound anemia. About 5 per cent of ulcer cases die of hemorrhage. Payr believes that 93 to 97 per cent of cases of gastric hemorrhage can be controlled by medical management. Fifteen or twenty years ago many operations were performed for hemorrhage of the stomach. Moynihan advocates gastro-enterostomy as a means of controlling gastric bleeding. E. Wyllys Andrews, of Chicago, operated upon a number of cases attacking the lesion direct with ligature and suture. Some surgeons excise the bleeding ulcer and others cauterize the lesion. The mortality was very high and these operations were soon generally discarded. Recently Finsterer who has done many stomach resections, has revived direct surgical attack in gastric bleeding and advocates resection under local anesthesia. Most surgeons advocate medical management in the face of severe gastric hemorrhage. This should be absolute rest, morphine, washing out the stomach, rectal fluids, alkalies to neutralize the gastric juice and ice bags over the abdomen and, in selected cases, transfusion.

The logical reasons for adopting this treatment are: First, that few die in the first attack. Second, these patients are very bad subjects for a severe operation such as the direct attack of the bleeding point and ligating or cauterizing it or resecting the ulcer. Third, in many cases of gastric hemorrhage the operation fails to reveal the bleeding point and is futile.

In cases of profound and deepening anemia from chronic hemorrhage, I believe that if any operation is done it should be a jejunostomy done under local anesthesia. This enables us to put the stomach at absolute rest and at the same time feed the patient. I was able once to save the life of a patient whose hemoglobin had gone down to 17 per cent.

In bleeding from carcinoma and other neoplasms in the stomach, the question is not so much the hæmorrhage which is not often fatal but the question of the removal of the neoplasm. Gastric hæmorrhage from cirrhosis of the liver is a dark chapter. The only cases which can be influenced by treatment are the cases where the cirrhosis is due to syphilis and here iodide of potassium and mercury should be employed with occasionally marked improvement or even cure.

Splenic anemia is a common cause of gastric hæmorrhage. Hæmatemesis in cases of leukaemia and hæmolytic jaundice are rare. Bal four of the Mayo Clinic, in an excellent article on Hæmatemesis, analyzes cases of hæmorrhage from lesions of the spleen and finds that 50 per cent of the cases of splenic anemia vomited blood but that enlargements of the spleen from leukaemia and hæmolytic jaundice were seldom associated with gastric hæmorrhage. In splenic anemia with gastric hæmorrhage the clear indication is a splenectomy after the patient recovers from the attack of bleeding and fortunately the prognosis is good. Most of the cases are cured by the operation if it is done fairly early before too extensive changes have taken place in the spleen and liver. In jaundice in cholemia, we not infrequently have hæmorrhages and sometimes gastric hæmorrhage. The clinical interest however in these cases centers around the bleeding that occurs after operation and the means which we can employ to prevent this complication. The accurate determination of the coagulation time is of great importance. Where this is slow we can use chloride of calcium or direct transfusion. Bal four states that in the Mayo Clinic Walters, following the recommendation of Lee and Vincent in their article published in the *Archives of Internal Medicine* (1915) on "The Relation of Calcium to the Delayed Coagulation of Blood in Obstructive Jaundice," has been able consistently to reduce the coagulation time of the blood by daily intravenous injections of 5 cubic centimeters of 10 per

cent of calcium chloride solution for a period of 3 days.

Hæmophilia is a cause of gastric bleeding, but a rare cause. When it does occur the best treatment in addition to the recognized general management of gastric hæmorrhage, is the subcutaneous or intramuscular injection of from 20 to 40 c.cm. of human blood and this may be repeated several times, and in serious hæmorrhage direct transfusion should be employed.

Gastric hæmorrhage in the newborn occurs sometimes with and sometimes without an associated jaundice. The pathology is not fully understood. The best treatment is the intramuscular injection of human blood, 10 to 30 cubic centimeters, and this is sometimes strikingly successful.

And finally I desire to refer briefly to gastric hæmorrhage which occurs after operations. We can easily understand the cases which occur after operation on the stomach such as resection and gastro-enterostomy. Here some failure in technique is usually responsible. The employment of interrupted instead of continuous suture, is a common cause. The employment of the three-row continuous suture of the Billroth school is the best method to guard against this accident. Reoperation in the face of postoperative gastric hæmorrhage is a trying ordeal and is usually futile. In addition, however to these cases of stomach hæmorrhage there are cases of hæmorrhage from the stomach which occur after abdominal operations in which the stomach was not involved. These have been noted by von Eiselsberg and regarded as due to thrombosis of abdominal veins.

In conclusion I desire to emphasize the importance of carrying to the bedside of the patient with gastric hæmorrhage a working knowledge of the pathology of the lesions and conditions which may produce it and the importance of determining, if possible in each individual case just what the cause is so that we may give the patient the benefit of rational and scientific therapy.



HÆMORRHAGE IN THE GENITO-URINARY TRACT<sup>1</sup>

BY WILLIAM F. LOWER, M.D. F.A.C.S. CLEVELAND

Associate Professor of Genito-Urinary Surgery at Western Reserve University School of Medicine; Director of Surgery, Mt. Sinai Hospital

**H**ÆMORRHAGE in the genito-urinary tract, which is manifested by hæmaturia like hæmorrhage elsewhere is only a symptom and should be considered accordingly. It is always pathological and never physiological even though its presence may be detected only by a microscopical examination. Hæmaturia is rarely accompanied by much discomfort and is generally intermittent. The importance of its presence, therefore is apt to be underestimated not only by the patient but also by the attending physician. In spite of the fact that the presence of blood may indicate a serious general disease or a lesion somewhere in the urogenital tract and should therefore be considered as a very important diagnostic sign.

An alarming hæmorrhage from the urogenital tract seldom occurs except in cases of trauma. A very slight injury may cause the rupture of a kidney or of the urethra with a resultant serious hæmorrhage. It sometimes happens, however that a hæmorrhage from some cause other than traumatism may be so profuse as to demand immediate operation and blood transfusion to save patient's life.

Before a final decision is made that the source and cause of the bleeding is in the genito-urinary tract a careful history should be taken and a complete physical examination made for in a certain percentage of cases, hæmaturia is due to some pathological condition outside the urinary tract. The ingestion of certain drugs such as cantharides, turpentine phenol urotropine etc may be the primary cause of the hæmaturia. A very interesting case has been reported recently by Ockerblad (5) in which a very marked hæmaturia resulted from the ingestion by the patient of a lead and zinc oxide mixture intended for urethral injection. Acute and chronic febrile diseases such as scarlet fever malaria etc., may produce hæmaturia. In cases of scurvy purpura leukemia pernicious anemia, septic infarct, aneurysm syphilis

and parasitic diseases, blood may appear in the urine. Hæmaturia has also been noted in certain conditions outside the urinary tract demanding surgical intervention, such as cholelithiasis and appendicitis. But in spite of this long list of possible causes hæmaturia is generally due to a lesion somewhere in the urogenital system.

This lesion may be situated anywhere within the genito-urinary tract, from the meatus to the kidney capsule and while it is true that the cause of the bleeding cannot always be determined even with modern facilities for diagnosis, its source can usually be identified. A suggestion as to the source of the bleeding may often be gleaned by observing whether or not blood appears at the meatus, as its presence here indicates a lesion somewhere anterior to the sphincter muscle. If blood appears at the termination of micturition it is suggestive and nearly always diagnostic, of a lesion within the urinary bladder. The presence of blood in the semen suggests a lesion in the seminal vesicles or in the prostate gland. If bleeding follows an attack of renal colic it suggests a lesion above the bladder.

Ulcerations and neoplasms of the urethra can nearly always be detected by the urethroscope or by palpation. Tumors, stones, ulcerations, and diverticula of the urinary bladder can easily be determined by means of the cystoscope and the X rays. If the source of the bleeding lies above the bladder ureteral catheterization and roentgenograms will be found to be of the greatest diagnostic aid. It should be borne in mind, however that the presence of a few red cells in the urine or even a hæmorrhage after catheterization may be due to traumatism by the catheter and thus will not be a true diagnostic index. For this reason ureterograms and pyelograms should be added to establish the diagnosis.

The source of bleeding is best discovered during a hæmorrhage rather than during the interval between attacks.

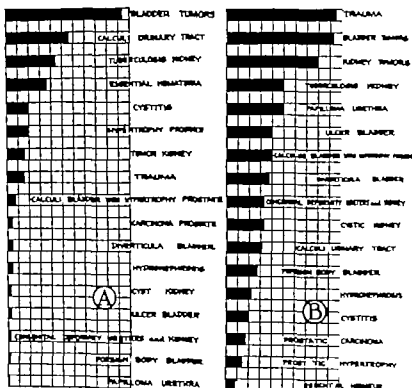


Chart A The relation of the primary cause to the total incidence of hematuria  
Chart B The relation of the occurrence of hematuria to the primary cause.

According to the experience of most urologists, the most common cause of hæmaturia is a growth somewhere in the genito-urinary tract. Three reporters (4, 6, 8) have found new growths to be the cause of hæmaturia in over 50 per cent of their cases and Hinman (2) in analyzing 709 cases of renal bleeding reported by eight surgeons, found that hæmaturia had been the initial symptom in 301 or 42 per cent, and that it was the only symptom in 14 out of 209 cases, or 6.6 per cent. In this group, Israel reported hæmaturia to have been the initial symptom in 70 per cent of his 66 cases and Braasch reported 83 cases of hypernephroma in 77 per cent of which hæmaturia had been present for a year before other symptoms precipitated treatment. In a series of 100 cases, Chute (1) found 64 per cent due to new-growths, 50 per cent of these being tumors of the bladder.

In general, tumors, tuberculosis, and calculi are found to be the most frequent and im-

portant causes of urogenital bleeding, although some consider nephritis as first in importance. Thus, Walther (6) has reported that among 74 cases of hæmaturia, 36 or 51 per cent, were due to tumors, 72 per cent of which were malignant, 13 or 9 per cent, were caused by calculi, 5 or 7 per cent, were due to renal tuberculosis, and in 4 the condition was diagnosed as essential hæmaturia. Kretschmer (4), in a report of 238 cases of hæmaturia, states that in 14 the source but not the cause of the bleeding was determined, and that in 25 cases the source was not determined. Of the remaining 197 cases, new-growths were responsible for 99 or 50 per cent. Tuberculosis accounted for the bleeding in 33 cases and urinary calculi in 32 cases while in 12 cases the bleeding was due to nephritis.

Hunner (3) believes that stricture is the cause of hæmaturia more often than is realized and that nephritic processes are often due to stricture. He believes that of Israel's

reported 14 cases of essential hæmaturia, 11 were due to stricture. Young (7) of Boston believes that a pre-nephritic condition may often account for blood in the urine.

In addition to these principal causes it should be added that hæmaturia may be caused by angioma or varicosity of the papillæ, or by vascular distention due to the mechanical rupture of blood vessels resulting from injury caused by some circulating injurious agent.

There is a certain group of cases, in which the bleeding comes from one or both kidneys, in which no pathological condition can be found. These are the cases of so-called "essential hæmaturia." That there must be a cause however even though it cannot be found is quite generally accepted for certainly if a person has hæmaturia there must be some reason for it.

A study of the case histories in my own series of 2,922 cases of diseases of the urogenital tract shows that hæmaturia was present in 798 or 26 per cent. In 32 per cent the primary cause of the bleeding was a new growth somewhere in the urogenital tract, in 11 per cent tuberculosis was the cause and in 16 per cent calculi were present (Chart A). That such figures as these do not, however give the true significance of hæmaturia as a diagnostic indication is shown by the following figures in which the relation of the presence of hæmaturia to different pathological conditions of this tract is indicated (Chart B). Hæmaturia was present in 93 per cent of our cases of tumors of the bladder, in 80 per cent of the cases of tumors of the

kidney in 50 per cent of the cases of tuberculosis, and in 48 per cent of the cases of calculi. As is shown by the charts, in our series most of the pathological conditions of the genito-urinary tract showed hæmaturia in a greater or less percentage of the cases. Among the cases of trauma, hæmaturia was present in all but two instances.

#### CONCLUSION

The above considerations emphasize the point that hæmaturia from the urogenital tract may be a symptom of almost any pathological condition within that tract and that therefore the presence of blood in the urine must be considered as an imperative indication for the application of every diagnostic measure at our command to locate the primary source of the bleeding, and that no case should be classified as one of essential hæmaturia until every diagnostic measure has been applied without avail.

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THE RELATION OF BLOOD-COAGULATION TIME TO POSTOPERATIVE HÆMORRHAGE<sup>1</sup>

By SAMUEL M. FEINBERG, M.D. CHICAGO

Instructor in Medicine, Northwestern University Medical School, Pathologist to the Frances Willard Hospital

THE determination of the clotting time of the blood previous to operative procedures, especially tonsillectomies and adenoidectomies is now a routine requirement in many hospitals. In spite of this fact, otolaryngologists and general practitioners have varying opinions as to the actual value of the test. Some have implicit faith in the value of the clotting time as a guide to the performance of tonsillectomies, and will hesitate to operate when the coagulation time is in the neighborhood of 7 minutes; others take the extreme opposite viewpoint, as exemplified in the case of one physician, who when told that his patient had a coagulation time of 20 minutes or over said "Fine send her up in the operating room immediately." Of course, the seriousness of operative procedures in such striking conditions as hæmophilia, chronic jaundice, leukaemia, purpura, etc. are well known and leave very little room for argument. This study however does not concern itself with cases of this character. We have attempted to determine what influence the coagulation time exerts upon hæmorrhage in a series of individuals who are apparently normal, with respect to the absence of any striking anaemia, jaundice, acute illness, or any other easily apparent abnormality.

## CAUSES OF HÆMORRHAGE

Before entering into a discussion of the results of this work, let us review the causes of hæmorrhage in tonsillectomies. In the first place, there is surprisingly scant statistical data showing the relation of coagulation time to hæmorrhage. Ballenger (1) Phillips (2) and the majority of other authors of standard textbooks on otolaryngology have very little or nothing to say with regard to this point. Any one who has given any thought to the matter knows of the many and various factors that may cause bleeding in tonsillectomies which have no direct relation at all to the clotting

powers of the blood. There may be an abnormal distribution of the blood vessels leading to the tonsil. The operator may inadvertently operate before the acute inflammation of the tonsil has subsided, and thus get hæmorrhage from the increased vascularity. The tonsils may be fibrosed due to recurring tonsillitis or peritonsillar inflammation. Various local causes, such as tuberculosis, malignancy and syphilis of the tonsils predispose to bleeding. Arteriosclerosis, cardiac disease, especially aortic insufficiency and hyperthyroidism are generally believed to increase the probabilities of hæmorrhage. The method of operation is generally considered to be an important factor. A number of other conditions such as age, sex, pregnancy, etc. are claimed by O'Malley (3) to be causative factors in hæmorrhage. A cause of bleeding which is by no means negligible is the skill of the operator. In one hospital for example, I believe that the clumsy technique of one operator in particular was the cause of the bleeding in a good share of the cases.

Several well recognized conditions may cause serious bleeding because of the faulty clotting powers of the blood. Hæmophilia, of course is the classical and at the same time most dreaded, example. Its outstanding characteristics being its hereditary tendencies, its occurrence only in males, hereditary transmission only through females, occurrence of spontaneous hæmorrhage and markedly increased clotting or bleeding time. Jaundice, especially of the chronic type disturbs the coagulative processes of the blood. In purpura hæmorrhagica, melena, neonatorum, necrosis of the liver, phosphorus poisoning, chloroform poisoning and acute yellow atrophy there is marked impairment of the clotting powers of the blood. As Dorrance (4) and others have emphasized in conditions such as pernicious anaemia, splenic anaemia, and leukaemia, there are periods in the disease in

which the coagulation time is delayed while at other times it may be normal.

Any one of several factors that constitute the process of clotting may be at fault in defective coagulation. And it is essential to appreciate that and have a working knowledge of the process of blood-clotting and the elements that enter into it if we are to learn successfully to treat or to prevent these hemorrhages. For instance, in melena neonatorum the cause, and therefore the treatment, of faulty blood coagulation is altogether different from that in obstructive jaundice. In the former there is a deficiency in prothrombin and injections of blood serum or blood transfusion are therefore beneficial. In the latter on the other hand there is a deficiency of calcium and administration of calcium salts is the proper procedure. The most widely accepted theory of coagulation, that of Howell, in his own words is as follows:

"In the circulating blood we find as constant constituents fibrinogen, prothrombin, calcium salts, and antithrombin. The last named substance holds the prothrombin in combination and thus prevents its conversion or activation to thrombin. When the blood is shed, the disintegration of the corpuscles (platelets) furnishes material (thromboplastin) which combines with the antithrombin and at the same time liberates more prothrombin; the latter is then activated by the calcium and acts on the fibrinogen.

From these observations we can readily see that abnormal clotting may be due to any of the following causes:

1. *Diminished amount of fibrinogen.* This is a result of injury to liver cells, as in acute yellow atrophy, chloroform poisoning, phosphorus poisoning, and yellow fever. In many cases of chronic cirrhosis of the liver as shown by Whipple (5) there is feeble clotting of the blood due to deficiency of fibrinogen. In such cases it is not so much the coagulation time that is altered as the firmness of the clot.

2. *Deficiency in prothrombin.* This occurs in melena neonatorum. In hemophilia the fault lies probably in a qualitative change in the prothrombin.

3. *Deficiency in calcium*

4. *Deficiency in thromboplastin.* It is highly questionable if this ever occurs because this element is derived both from blood and tissue cells.

5. *Excess of antithrombin.* Experimentally this is produced by injections of peptone or hirudin. Clinically it is said to be increased in septicemia, pneumonia, and miliary tuberculosis.

From a practical point of view it is well to remember that so far it has not been shown that normal coagulation time can be decreased by the administration of substances which aim to alter the blood-clotting elements and consequently hemorrhage in an individual with normal coagulation time will not be controlled by horse serum, conglobulin, prothrombin, gelatin, etc.

With due regard for the previously mentioned rather infrequent causes of delayed clotting of the blood there still remains the mass of individuals, who are more or less normal, but who present marked differences in their blood coagulation time. And the question arises, what relation does the clotting time have to postoperative hemorrhage in such individuals?

#### PROCEDURE

An attempt was made to answer this question by a study of 500 cases of tonsillectomies and tonsillectomy-adenoidectomies at the Frances Willard Hospital operated on between April 24 and October 6, 1923. There was no selection of cases for this study all coagulation tests being made on the patients as they presented themselves at the laboratory. The clotting time determinations were done chiefly by me and the remainder were made under my direct supervision. It is, of course, common knowledge that the time of coagulation varies greatly with the methods used and the methods are legion. However according to most authors, the method of Brodie and Russell (6) as modified by Boggs, is the most accurate and simple method for clinical purposes. The apparatus consists of a truncated cone of glass projecting into a closed chamber provided with a tube on the side, so arranged that when air is blown into the chamber by means of a rubber bulb it strikes the drop of

blood on the end of the cone at a tangent. The procedure followed was to cleanse the lobe of the ear pierce it so that the blood appeared with practically no pressure wipe away the first drop and to use the second drop. The time of appearance of the second drop was accurately noted and the drop was then placed on the truncated cone and inverted into the chamber and placed under the low power lens of the microscope. Coagulation was watched for by gently squeezing the bulb about every 30 seconds. Before clotting sets in the individual corpuscles move freely in a circular direction. When clotting begins the cells move in masses and then they become fixed so that when the air current strikes them they move somewhat but return immediately to their original position. This latter was taken as the end point in all the cases studied.

These cases were followed up as to the occurrence of either operative or postoperative hæmorrhage. It was not the intention of the author to study those cases who have the ordinary slight bleeding but rather to note only those having serious or profuse hæmorrhage. It is apparent that it is a rather unpractical feat to determine the degree of bleeding by accurate measurements. My criterion for the hæmorrhage under consideration was that degree of bleeding sufficient to be noted by anxiety on the part of the attending physician and which called for active general or local measures. The anaesthesia was nitrous oxide ether anaesthesia in the majority of the cases. It is to be regretted that the operative technique which was used on each case was not recorded.

#### RESULTS

In this series of 500 cases the range of clotting time was between 1 and 9 minutes. The average clotting time for the entire series of cases was 3 minutes 58 seconds. Of these 16 or 3.2 per cent had profuse hæmorrhage, and the average coagulation time of the latter was 4 minutes 23 seconds.

Of the series, 288 cases were under 15 years of age with an average coagulation time of 3 minutes 56 seconds. Seven of these or 2.4 per cent, had severe hæmorrhage.

Of the series, 212 were over 15 years of age,

with an average coagulation time of 4 minutes 3 seconds. Nine of these, or 4.2 per cent had severe hæmorrhage.

Of the 288 cases under 15 years of age 149 were boys, with an average coagulation time of 3 minutes 55 seconds. Three of these or 2.0 per cent had severe hæmorrhage.

Girls under 15 years of age numbered 139 with an average clotting time of 3 minutes 57 seconds. Four of these or 2.9 per cent, had severe hæmorrhage.

Of 212 individuals over 15 years of age 73 were males, with an average coagulation time of 4 minutes 15 seconds. Two of these, or 2.7 per cent, had severe hæmorrhage.

Of those over 15 years of age 139 were women with an average clotting time of 3 minutes 57 seconds. Seven of these or 5.0 per cent had severe hæmorrhage.

In this series of 500 cases there were 37 having a coagulation time of 6 minutes or over. Combining these 37 cases with 34 others previous to the series under consideration, we have 71 cases with a coagulation time of 6 minutes or over among whom we can attempt to watch for any increase in tendency to hæmorrhage. Of these 71 cases, only 3 or 4.2 per cent had severe bleeding.

The results of the above study may be strikingly summarized in the following table.

	Average Coagulation Time	Profuse Hæmorrhage Per cent
Entire series (With average coagulation time of 3 min 58 sec or 4 min 3 sec)	3 min 58 sec 4 min 3 sec	3.2
Children	3 min 56 sec	4
Adults	4 min 3 sec	4.2
Boys	3 min 55 sec	
Girls	3 min 57 sec	
Men	4 min 5 sec	2.7
Women	3 min 57 sec	5

Among 71 cases with coagulation time of 6 minutes or over 3 or 4.2 per cent had severe hæmorrhage.

#### SUMMARY AND CONCLUSIONS

In a study of 500 cases of tonsillectomies and adenoidectomies from the standpoint of the relation of the coagulation time of the blood and hæmorrhage, with due consideration for the limitations in the quantity and character of the clinical material encountered it was found

- 1 That the coagulation time is not apparently influenced by such factors as age and sex.
- 2 That the average coagulation time for cases having profuse hemorrhage was not much higher than the average for the series.
- 3 That in a series of 71 cases with a coagulation time of 6 minutes or over the frequency of hemorrhage was very little higher than that for the series of 500 cases.

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## MULTIPLE SKELETAL METASTASES FROM CANCER OF THE BREAST

BY JAMES E. THOMPSON, F.R.C.S. (Eng.) F.A.C.S. AND VIOLET H. KEILLER, M.D. GALVESTON, TEXAS

**M**ULTIPLE rarefying central lesions in bone having a roentgenological appearance of expanding neoplasms tempt one to make a diagnosis of multiple myeloma. Metastatic cancerous deposits may give identical roentgenograms and before the diagnosis of multiple myeloma can be established most careful examination must be made to eliminate any possible focus of carcinoma. The case here presented appears worthy of record because of the chronicity and enormous number of the bony deposits and the comparative insignificance of the primary cancerous tumor and late development of other metastatic foci. By good fortune it was possible to obtain accurate records of the patient for a period of one year before her death, and as the body became the property of the Medical School, complete dissection could be made.

Through the courtesy of Dr. Dalton Richardson, of Austin, Texas, the early findings and X-ray pictures were available. The history as recorded below was obtained from the patient, 4 months before her death and the diagnosis at this time was much less difficult than in the early months of her illness. Indeed, when she first applied for medical attention, her skeletal lesions so completely dominated the clinical picture that there seemed no doubt that they were primary i.e. multiple myeloma.

On May 28, 1921, 13 months before the patient's death, she applied to Dr. C. H. Brownlee at the City Hospital in Austin, Texas, for treatment for fracture of the humerus. She gave the history that 2 weeks previously while attending a revival meeting she threw up her arm and felt it break near the shoulder. The arm was bandaged by a negro doctor but did not appear to her to be healing well. Dr. Brownlee realized that there was some pathological condition in addition to the fracture as the patient had evidence of tumors in both upper arms. She was sent for roentgenological examination to Dr. Richardson.

Tumors of the upper part of the shafts of both humeri were discovered and Dr. Richardson made X-rays of the rest of the skeleton. In addition to the large masses in the humerus several nodules were visible in the ribs, in the scapulae, in the right femur and in the pelvis. In the right humerus an imperfect bony shell surrounded the rarefied tumor area. In the left humerus, the bone shell was much less distinct. The other tumors which were recognizable at this time showed no bone shell but had the appearance of more or less circumscribed rarefactions. This is particularly well shown in the case of the neck of the left femur and the two iliac bones.

In examining the patient, an enlargement of the left breast was found, but the patient insisted that this had been present since she was 10 years of age and that it was due to the traumatism of carrying a bag of cotton slung over the left shoulder. The long duration of the breast tumor and the youth of the patient as she was then but 28 years of age seemed to rule out the diagnosis of malignant disease of this breast. Ulceration was not present at this time but occurred shortly after the patient's admission to the hospital. The entire breast was enlarged and had rather the appearance of fibroid mastitis. When ulceration did occur it was attributed to growth coming from a rib below and while the early X-ray had shown no tumor in this particular situation, it was supposed that a new lesion had developed here. It has to be noted that at this time, there was no evidence of glandular involvement. The X-ray plates were presented by Dr. Richardson at the December 1922 Meeting of the North American Radiological Association. By this time the diagnosis of metastatic carcinoma had been established but the majority of the radiologists present who were unacquainted with the pathological findings, were inclined on the basis of the roentgenograms alone to consider the case one of multiple myeloma.





Fig. 2. Roentgenogram of left hemithorax taken after spontaneous fracture 3 months before death. Figures 3 and 4 are taken at the same time as Fig.



Fig. 3. Thorax showing lesions in the ribs, not very numerous nor large at this time.



Fig. 4. Right lateral view, showing bone shell formation about the tumor.

The history and physical examination of the breast when the patient first applied for treatment did not suggest carcinoma. Nine months later, after the ulceration of the breast had appeared, there was no doubt that the breast was malignant even at this late date; however, there were no palpable axillary deposits and the supposition that the tumor was an extension from the underlying ribs seemed well founded. In view of the unusual interest of the case, Dr. Brownlee arranged to have the patient transferred to Galveston in order that students of the Medical Department of the University of Texas might see the case.

#### HISTORY

J. L., age 38, female negro, of Austin, Texas, was admitted to the Austin City Hospital May 13, 1922, and transferred to the John Sealy Hospital, Galveston, February 7, 1923. Died June 9, 1923. The mother died when patient was a infant. The father is living and well. Three brothers and one sister are living and well. One brother was killed in the war. The family history is negative for cancer and tuberculosis.

**Previous history.** Patient had measles in childhood, influenza about 3 years ago. One year ago she had chills and fever. She had been married twice. By her first husband she had 4 children, one 1 year and one 9 years of age. She had been married to the second husband 3 years and had not been



FIG. 4. A and B. Multiple tumors in the pelvis, one tumor in neck of left femur. Note the absence of any condensation or osteoblastic reaction surrounding the lesions. Many of the tumors here shown remained practically stationary in size until the patient's death, 5 months later.

pregnant in that time. Four or 5 years ago she began having yellowish vaginal discharge which was rather profuse and somewhat irritating. This discharge was now constant but she had not menstruated since last May 10 months ago. Before that time her periods had been regular. She had been troubled with constipation practically all her life. She had drunk as much as one half glass of whiskey and a bottle of beer a day she preferred high protein diet. For some time she said her stomach filled up quickly and felt uncomfortable. She took but small quantity of food and regurgitated most of that at intervals, without any effort or retching. She formerly weighed 85 pounds, but had been losing flesh for many years and now weighed about 60 pounds.

**Present illness.** Patient states that she has had a small lump in her left breast since she was about 10 years of age. It was as large as a quail egg when she first noticed it and remained stationary in size until about 4 years ago. At that time she began to suffer the pain of dull, ching character in both flanks and around the umbilicus. She described this pain as traveling over the abdomen in a path that corresponded fairly well to the position of the large intestine. She has had periods of relief from the abdominal pain, but it has continued at intervals to the present date. At about the time that the abdominal trouble started she noticed that when she tried to pack cotton her back seemed about to break at a point about 1 inch below the iliac crests. The pain in the back was so sharp that she would have to stop and rest for time. At this same period of her illness the patient noticed that the lump in her left breast was increasing in size. This she attributed to the fact that in packing cotton she carried the bag across her shoulder and caused pressure on the left breast. Both her children nursed almost entirely from her right breast. She states that the breast has been gradually increasing in size for the last year or two, but has never been painful. She states that the lump in her breast was entirely in the outer and upper quadrant but about 9 months ago the skin over the

lump broke through and after that the lump seemed to move toward the middle of the body. The breast is not painful now unless it is lifted over the ulcerated area. Early in May 1932 while about at a revival meeting she threw up her left arm suddenly and felt it break. A colored doctor bandaged the arm. It began to heal in a faulty position, so she applied to the Austin City Hospital for treatment. She states that for some time before the accident, she had very little use of her arm. Patient did not remember when her shoulders began to swell she attributed the swelling of the left arm to the injury and did not notice the increase in size of the right shoulder.

**Physical examination.** February 1932. Patient is greatly emaciated, this condition being more apparent in the body than in the face. The patient lies quietly in bed on her back with the left thigh drawn up. She seems quite comfortable and does not look seriously ill. She looks fairly bright, though she often becomes confused in giving her history and occasionally gives impossible answers to questions. When asked to turn in bed she complains bitterly of pain in the back which appears localized at a point in the vertebral column just above the line joining the iliac crests.

The skin is dry and harsh and shows evidence of long continued neglect. The mucous membranes are pale. Blood examination, March 6, 1932, 5,353,000 red cells, 90 per cent hemoglobin, 8,480 white cells, normal differential.

The muscles over the body are atrophied from disuse. This is particularly noticeable in the arms.

The eyes are normal. The ears are well shaped, no discharge, good hearing. The nose is normal. The tongue has a thin, whitish coat and is pale in color. The teeth are all present and show no decay but some soreness. The tonsils are somewhat reddened. The thyroid gland is normal in size.

Examination of the chest shows great emaciation, and the intercostal spaces are depressed. The left breast is three or four times larger than the right, which is small and flabby. The left breast is hard



Fig. 5. Photograph of left breast. Darker areas are carcinomatous, not the extreme degree of fibrotic contracture. The wrinkling of the surface is due to the escape of edema-tous fluid when the organ is cut.

and breast the skin is shiny, and in the upper left quadrant shows peg skin slumping. The nipple appears retracted, because of the edema surrounding it. Below the overhanging breast and the chest wall is bleeding ulcer covering an area about 1 inch long. The breast tissue is adherent to the chest wall on the medial side. The axillary glands are not palpably enlarged, at this time.

The lungs are negative. The blood pressure is 12-80; the radial pulses equal and synchronous; the heart rapid but regular with no murmurs.

The abdomen is scaphoid in shape, shows no fat and the skin is wrinkled. Aortic pulsations are easily perceived. There is tenderness on deep pressure in the midline below the umbilicus, and in the right iliac fossa; no muscular rigidity.

The uterus and adnexa are apparently normal except for a profuse cervical discharge. Urine examination is negative. Hence Jones protein test is negative.

Deep pressure over the bed of both femora elicits some pain. Movement of the left thigh is restricted; patient keeps this thigh flexed on the abdomen and adducted. No tumors are palpable. Otherwise the lower limbs are negative. The bones of the upper limbs are easily palpated because of the extreme emaciation. Both humeri present tumors about the size of small grape fruit. The left shoulder joint is intact but just below this the humerus is expanded by tumor. There is no pain in the tumor and no tenderness on pressure over it. The round swelling of the left arm begins lower down than that of the right. Below the shoulder joint there is palpable exte-*r* of humerus along the surgical neck that is normal in size. Below this is swelling of the humerus about the same size as that described for the right arm. Considerable deformity has been produced by the fracture 9 months ago, the carrying angle being increased and medial rotation practically lost. There has been some union, for the patient can use the arm fairly well and suffers no pain. The forearms and hands are normal.

There is marked scoliosis in the lower dorsal and lumbar regions. About one inch above the iliac crests, the spines are very prominent. The patient complains of pain in this situation, especially on deep pressure or on movement of the body. The sacrum is clearly palpable due to the emaciation; it appears normal.

Sensations appear to be normal. Knee reflexes are absent or sluggish as patient lies in bed. Complete neurological examination could not be made on account of the weakened physical condition and lowered mentality of the patient. Pupils equal and react normally.

**Treatment.** With a view to removing the painful ulcerated tumor of the breast, obviously malignant, and of establishing the diagnosis of the bone lesions, the patient was operated upon March 3, 1923, by Dr. James F. Thompson. General ether anesthesia was used. An incision was made anteriorly over the tumor of the left arm in the interval between the deltoid and the pectoralis major, avoiding the cephalic vein. The tumor was exposed, the enveloping shell of bone broken through and small portion of tissue removed for diagnosis. A large amount of blood was found within the shell of bone and also rather hard tumor mass. Small piece of bone was curetted with piece of bone attached. The wound was closed without drainage.

The left breast was removed partly by the knife and partly by cautery. An attempt was made to clean out the axilla or infraclavicular area because of the possibility that the bone tumors are metastatic from the breast and the futility of a complete breast operation in the face of so much pathology elsewhere. The wound was closed without drainage.

**Postoperative history.** The wound on the arm healed by first intention. The breast wound opened at the point of greatest tension on the chest and granulation in this region was very slow eventually however it healed entirely. The left axillary glands enlarged rather rapidly shortly after the operation. On April 6, the interns noticed rather marked change in the mentality of the patient. She became indifferent to pain and lay in semi stupor. From this time until her death on June 20, 1923, there was progressive

weakness and emaciation. Two weeks before her death an examination of the lungs was made in the course of routine and round but nothing was found. Enlargement of the liver was noted at this time. A systematic neurological examination as ever made nor was the patient's condition such that it could have been satisfactorily conducted.

#### PATHOLOGICAL REPORT

**Specs.** March, 92. Left breast which was excised March 3, is enlarged, intensely fibrotic, with small scattered cysts. The whole organ is greatly increased in size by edema. In the lower outer quadrant are two solid masses of carcinoma, separated from one another by fibrous breast tissue. These are respectively 5 centimeters and 4.0 centimeters in

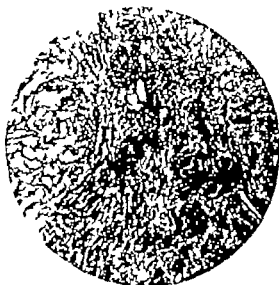


Fig. 6. Photomicrograph of the outskirts of the breast tumor. Here the epithelial origin of the growth is easily seen. Toward the center the tumor becomes much less fibrous and has an appearance identical with Fig. 7.



Fig. 7. Tissue removed for diagnosis from left humerus here the tumor mass measured 6 by 8 centimeters. The structure is that of medullary carcinoma, identical with the interior of the breast tumor.

diameter and the larger which is in the pendulous portion of the breast, has ulcerated through the skin giving rise to depressed areas. Microscopically the nodules show cell mass type of medullary carcinoma, with great amount of fibrous tissue on the outskirts of the tumor. The tissue of the remainder of the organ shows precancerous proliferation of the duct epithelium, dense fibrous tissue, edema, and slight round cell infiltration. The tissue removed from the humerus shows the same microscopic picture as the cellular central portion of the breast nodules.

**Pathological diagnosis.** Carcinoma arising in chronic fibroid mastitis; secondary deposit in bone.

**Autopsy protocol.** Death occurred June 19, 9 the body was embalmed on the same day. Examination of the thoracic and abdominal organs was made June 28, by Dr. Henry Hartman. Further examination involving the dissection of the entire body was made by Dr. V. H. Keiller. The following report summarizes the complete findings.

**External appearance.** The body presents the appearance of extreme emaciation. The legs are drawn up, bed sores are present on sacrum and over right trochanter and external malleolus. The scar on the left chest from breast amputation has healed, and there is no external evidence of recurrence except adherence to the chest wall. On reflecting the musculocutaneous flap on this side for the exposure of the ribs, the scar was found to be adherent to one or two cancerous nodules on the underlying ribs. The right breast is rather large, freely movable, and internally fibroid. Small cysts show in the fibrous tissue. Ex-

cept for the lack of edema this breast is similar to the non cancerous areas of the left breast. Microscopically it shows fibroid mastitis.

The heart and pericardium are normal. The aorta shows slight thrombosis.

**Lungs and pleura.** The pleural cavities contain about 300 cubic centimeters of blood stained fluid. The parietal pleura is normal except for a few scattered nodules on the right side of the diaphragm, to which a portion of the lung is adherent. Both lungs contain many white, scattered, cancerous nodules, varying in size from a pin head to a pea or slightly larger. These are more numerous in the apices and in the middle lobe of the right lung than elsewhere. The visceral pleura shows similar nodules, especially along the sharp lower margins of the lobes, where the small deposits give a fringed appearance. Small areas of consolidation surround all the nodules, but the lungs as a whole crepitate and float in water.

**Genito-urinary system.** The kidneys, ureters, and bladder are normal. Microscopic section shows slight cloudy swelling and congestion of renal parenchyma. The testes and adnexa are normal, with no evidence of old tubal infection.

**Gastro-intestinal system.** The stomach, intestines, and pancreas are normal. The liver is somewhat larger than normal, the surface deep red with no evidence of fatty infiltration, no mottling. Scattered over the entire surface and throughout the interior of the organ are white, cancerous nodules varying from centimeter to 4 centimeters in diameter. On the surface many are umbilicated. The largest deposit is found around the longitudinal fissure and

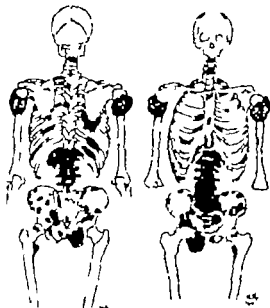


Fig. 8. Diagrammatic representation of the skeletal lesions found at autopsy. This is intended to portray the lesions graphically rather than with extreme accuracy. Some of the small osteoblastic lesions have been omitted. The lesions represented as occupying the costal cartilages should be in the bone at the osteochondral junction.

the attachment of the falxform ligament. And the fact that there are nodules along the falxform ligament suggest that growth has been carried by direct extension from the retrosternal tissues. The gall bladder is normal.

**Ductless glands.** The suprarenal capsules and the thyroid gland are normal. The hypophysis is rather small. The infundibulum ends in a sac-like dilatation which leaves the large pituitary posterior lobe. There is no evidence of pathological condition.

**Hematopoietic system.** The spleen is slightly enlarged, the capsule thin, the cut surface deep red with prominent malpighian corpora. A accessory spleen 3 centimeters in diameter is present near the hilus. A cancerous deposit is present in either the spleen or in accessory. Microscopic examination shows congestion and lymphoid hyperplasia only.

**Lymph nodes.** All the lymph nodes of the body were examined with great care. Except in the cases in which the metastatic deposits are present, they were extremely small probably as a result of the general depletion. In no instance was the cancerous deposit in the nodes of great size. The largest metastases are those of the left axilla and even here the glands are discrete and remnants of lymphatic tissue are still present around the cancerous focus. Deposits in the lymphatic system are found in the following situations:

One left iliac node

One pre-aortic node just below the diaphragm

One or two anterior diaphragmatic nodes

Bronchial nodes on both sides formed masses the size of an English walnut, composed of discrete gland containing small deposits.

One retrosternal (internal mammary) node at the level of the third intercostal space on the left side was about 1 centimeter in diameter.

Left axillary lymphatic and supraclavicular nodes. The axillary and supraclavicular group of the left axillaries form a mass of discrete nodes held together by 6 to 4 centimeters side the central and pectoral groups show practically no enlargement. The interpectoral could not be identified. The infraclavicular group consisted of two rather large nodes with cancerous deposits the supraclavicular 1 or three small nodes of solid carcinoma.

One pretracheal gland on the left side.

Right axillary and infraclavicular group. The axillary mass is half the size of the left otherwise similar. The right supraclavicular nodes are also affected. An interpectoral was found on this side.

It appears from the groups affected and the bilateral character of the axillary involvement that the deposit in these nodes probably came by way of the lymphatic system rather than directly from the breast cancer. No other cancerous lymph nodes were found in a most painstaking dissection of all lymphatic tissue.

**Vermin system.** The meninges are normal. The cerebellum contains tumor 3 centimeters by 5 centimeters, occupying the lower portion of the right lateral hemisphere. This has caused some distortion of the cerebellum and some herniation into the right side of the foramen magnum. The tumor involves the entire thickness of the arbor vitae the central core of the matter in the vacuity is edematous. The corpus dentatum is not encroached upon. The cut section shows some fatty cysts in its interior similar to those frequently found in breast cancer. The bulk of the tumor is solid like the deposits elsewhere in the body.

Except for a slight increase in the size of the lateral ventricles the remainder of the brain is normal.

The spinal cord is normal grossly, but macroscopically it shows posterior sclerosis of the lumbar type.

The peripheral nerves both cranial and spinal are normal except that those of the left side of the lumbosacral plexus are distorted by the tumor of the ribs of this region. Nerves are directly involved in the tumor masses.

**Skeletal system.** The greatest interest in the case is about the skeletal deposits many of which are found clinically. Even the x-ray pictures however did not reveal the enormous number of small foci present though this is partly due to the time between the latest roentgenological examination, February 9, and the death of the patient in June.

One small ulnar centimeter in across occurred in each parietal bone of the skull with no projection into the cranial cavity.

With the exception of four of the cervical vertebrae and the coccygeal all the vertebrae contained one or more cancerous deposits. The extent of the involvement follows:

Cervical vertebrae: fourth—body inferior articular process lamina and pine two foci sixth—body entirely destroyed, contour preserved seventh—body entirely destroyed, contour preserved, left lamina and spine 1 o foci

Thoracic vertebrae: first—right transverse process second—spinous process third—three small discrete foci in body fourth—hole body eighth—twelfth—all bodies are completely destroyed but remnants of the intervertebral discs remain so that the outlines of the separate vertebrae are preserved. The laminae and spinous processes are also involved but have preserved their outline to a considerable extent. The right pedicle of the seventh is affected and the left pedicle of the twelfth is involved in deposit which merges with one in the twelfth rib.

Lumbar vertebrae: All the lumbar bodies, pedicles laminae and spinous processes are involved in a practically solid mass of carcinoma in which the individual vertebrae are fused. The three lower transverse processes—the right side and the two lower on the left emerge from the mass. There is a marked lateral curvature in this region.

Sacral vertebrae: First and second—bodies are destroyed by bulging growth third—body contains small deposit both sides contain small deposits third and fourth—a large mass springs from the left transverse processes virtually closing the great sciatic notch fourth and fifth—bodies contain small masses and both sacroiliac articulations are affected.

The sternum shows scattered nodules in the manubrium and one fairly large deposit opposite the fifth sternocostal space.

Examination of the ribs shows, on the right side first—two large deposits second—two large deposits third—one deposit fourth and fifth—one on each outer angle and one at costochondral junction, sixth—three deposits seventh—two deposits eighth and ninth—large fused mass at the angles tenth—small nodules eleventh and twelfth—one large mass in each not fused to fifth—no deposit. On the left first—all involved second—one large mass at angle third—small deposits third—small deposits fourth—one small deposit fifth—two small deposits sixth and seventh—small deposit each eighth—one very large mass at angle ninth—one large and two small deposits tenth—one small deposit eleventh—no deposit twelfth—large mass blending with that involving the transverse process of the first lumbar vertebra.

It should be especially noted that despite the tremendous enlargement of the lumbar vertebrae and extensive involvement of the whole spinal column, no narrowing nor deformity of the lumen of the vertebral canal is present at any point nor is the dura mater involved.

Examination of the pelvic girdle shows that the left ilium contains eleven fourteen separate de-

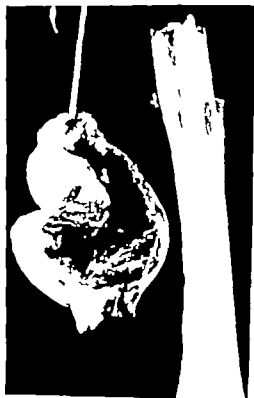


Fig. 9. Macerated specimen of the right humerus. This is the only lesion in which shell of new bone as well formed.

posits of varying size. The right ilium contains eight or ten. The left ischium contains four deposits. The left pubis contains one large deposit. The rami of the right pubis and the ramus of the right ischium are fused in one large mass which completely obliterates the obturator foramen.

In left femur one mass in olves the lesser trochanter and small ones below and above this. The marrow of the upper one third of the shaft of this bone is gelatinous like that to be described in the humeri that in the lower two thirds is normal fatty marrow. Except in this bone and the two humeri the marrow is entirely normal in all the bones examined.

Right femur and the leg and foot bones on each side were normal. All joints normal.

Examination of the shoulder girdle shows both clavicles normal. The right scapula shows one deposit near the inferior angle. The left scapula has two deposits near the inferior angle and one just below the glenoid cavity.

The upper ends of the shafts of both humeri are involved in large deposits. On the left the mass measures 6 by 8 centimeters; the bone shell is practically destroyed; spontaneous fracture has occurred through the tumor. From this deposit a specimen was taken for the biopsy in March. On the right side

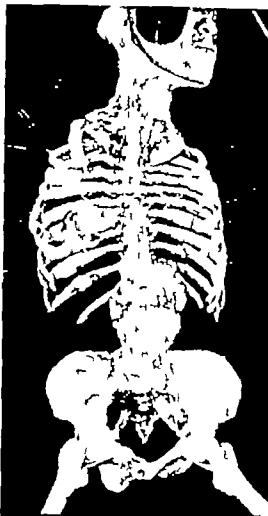


Fig. Anterior view of the skeleton. The rib fracture occurred in the course of preparation.

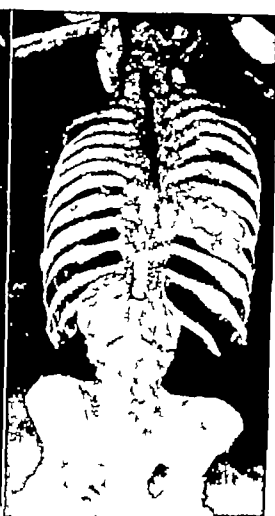


Fig. Posterior view of the skeleton. The large lumbar tumor is well shown.

the tumor is slightly smaller, the head distorted by old fracture, the bony shell fairly well preserved. This specimen was macerated and photographed. Below the lesions the marrow cavities are filled with reddish, gelatinous marrow, practically acellular on macroscopic examination.

The bones of the arms and forearms are normal, so also is the marrow in those examined for this point.

The muscular system is not affected except by pressure where the skeletal tumors are of large size. There is no tendency on the part of any of the tumors to invade muscle except by contiguity.

Some of the deposits in the skeleton are of long duration as is evident from clinical history and size

others are of recent origin. The enormous number of these deposits suggests early blood stream generalization but the spleen and kidney escaped and the lungs show only very recent deposits, certainly only a few weeks old. Macroscopically all the tumors are the same, having small rounded epithelial cells, little fibrous frame, and no organization in the size and shape of the malignant elements. Cystic changes are seen in the cerebellar deposits only. In most of the tumors there is no fibrous reaction, none (in the right scapula) showed dense fibrous and some limiting bone formation. The right humerus also showed well developed bone shell. There is no evidence of myeloma or of other pathological condition.

## DISCUSSION

Before entering into a discussion of the peculiar clinical and pathological features of the case, it may be well to summarize the important points in the progress of the disease. From the age of ten, the patient had had a lump in the left breast (fibroid mastitis of traumatic origin). This she stated very definitely and there seems no reasonable doubt that the statement is correct. After remaining quiescent for 17 years the lump began to take on a malignant character. At the same time evidences of malignant disease of the lumbar spine appeared in the form of pain and weakness in the back. This was so important to the patient that the painless growth in the breast attracted no attention. Over one year later spontaneous fracture of the humerus called attention to the presence of large humeral tumors, which had evidently been present for some months. The breast tumor even at this time was so comparatively insignificant that it attracted but little attention from the medical attendants. Many skeletal deposits were demonstrated by X ray at this time but there were no chest nor abdominal metastases and *no lymphatic enlargements*. Nine months later when the breast tumor was removed and biopsy performed on the arm, there was no evidence of metastases to other organs nor to lymph nodes and the primary growth in the breast, consisting of two tumor masses separated by an area of fibrous mastitis was smaller than one of the humeral tumors. Moreover recurrence did not make its appearance in the skin though at the autopsy nodules were found in the ribs below the breast scar. Probably the cerebellar lesion was the next to develop after the skeletal deposits as the patient's lethargy 3 months before death seems to indicate increased intracranial pressure. Lymphatic node involvement did not occur until 3½ months before death. It was then recognized by the palpation of a small nodule in the left axilla. At the time of death the whole mass of all cancerous nodes in the body did not equal in size the larger (left) humeral tumor. Liver involvement was late (as shown by its size) but rapidly spreading the lung metastasis was extremely late. The spleen and kidneys were never affected.

One is at once impressed with the peculiar selectivity of the lesions. Direct extension of growth to neighboring lymph nodes, generalized lymphatic or blood stream involvement, or distant haphazard secondary deposits from emboli in the circulation, are readily understood. In this patient at a very early stage in the disease numerous foci appeared in practically all the bones of the trunk, and in the humeri and in one femur. Sampson Handley expressed the belief that the skeletal deposits in cases of cancer of the breast were due to lymph drainage above fascial planes. He considered that the usual absence of growths below the elbows and below the knees were explained by this. It appears reasonable to suppose that growth through lymph channels to bones would give rise within the time allowed 2 years to lymphatic tumors which would clearly demonstrate the route of infection. The palpation of the axillary nodes in an emaciated subject is comparatively easy. No enlargement of these nodes was demonstrable in this case until many months after the development of the humeral masses. The lumbar vertebrae contained the largest mass in the body. Between it and the primary tumor the affected glands which were one pre-aortic, one or two anterior diaphragmatic, and two small masses of bronchial nodes, still retained their characteristic anatomical features, probably indicating recent involvement. It appears much more probable that the lymphatic followed the osseous deposits. These osseous deposits so early and so numerous, appear to have been disseminated by the blood stream. One can only suppose some inherent difference in tissue resistance permitted growth here while inhibiting it in other organs.

One other feature of the case requires special mention. The gross appearance of the bone lesions as exposed at autopsy was typically that of carcinoma. Microscopically also where a sufficient portion of growth could be studied, the characteristic arrangement of medullary carcinoma was readily perceived. The cancerous character of the humeral tissue was obvious. Had the breast tissue not been available, the histologist expecting a primary bone lesion might have been led to the suggestion of "alveolar round cell sarcoma."



SOME PHASES OF THE PATHOLOGY OF THE APPENDICES  
EPIPLOICÆ

WITH A REPORT OF FOUR CASES AND A REVIEW OF THE LITERATURE

By PERCY KLINGENSTEIN M.D. New York  
Adjunct Surgeon Mount Sinai Hospital

IN the past few months we have encountered two instances in which the appendices epiploicæ have been the cause of acute abdominal conditions necessitating immediate operative interference, and an equal number in which the pathological states of the appendices were associated with other intra-abdominal lesions for which operations were primarily undertaken. The first of these proved to be the presence of a completely twisted and gangrenous appendix epiploica in the sac of what appeared to be clinically a strangulated left inguinal hernia. In the second case a like structure was found strangulated in the neck of a left femoral hernia. The other two instances were twisted, acutely inflamed appendices epiploicæ encountered accidentally in the one case in the performance of an appendicectomy for an acute gangrenous appendix vermiformis in the other in the performance of an autopsy in which death was caused by an acute hemorrhagic pancreatitis. These have proven in a search of the literature, to be only some of the phases of a variety of lesions which may have their inception in these processes. Pathological states of the appendices epiploicæ furnish a particularly interesting chapter in the emergencies of abdominal surgery because of the rarity of these conditions and the difficulties in diagnosis to which they give rise. It is for this reason that I believe the subject to be of sufficient interest to place these cases upon record, to discuss briefly some of the phases of the anatomy physiology and pathology of these organs and to review the literature which has grown up about them.

## ANATOMY AND PHYSIOLOGY

Appendices epiploicæ are localized pedunculated overgrowths of subserous fat directly

For a complete bibliography with an abstract of the case histories reported in the literature, see article by V. C. Knott published in Ann Surg 1909, Nov. 37-46.

continuous with the fat in the layers of the mesentery (Bland Sutton, 3.) They are formed by a reduplication of the peritoneum which encloses a variable amount of fatty tissue between its two layers, and consist of small processes or pouches which are confined to the large intestine none appear on the rectum.

They have been variously designated by different authors. Robinson (34), from whose excellent monograph on the subject I quote freely calls them sero-appendices to indicate that they bear an intimate relationship to their peritoneal investment. Some have termed them fatty fringes or adipose appendages others appendices épiploïques (Meckel 22) "appareil séro-grassey" (Poirier 32) which appears to be the most composite term yet applied to them.

The appendices epiploicæ are not universally present in vertebrates. Dogs, cats, and rabbits have only rudimentary structures corresponding to the appendices of man. They are entirely absent in cows and sheep, but are well developed in anthropoid apes (Robinson 34). Authors disagree as to the time when they first appear in the human body. Meckel (22) states that they are found at the fifth month of intra uterine life. Sappey (33) and Testut (40) that they are unable to find even a trace of these structures in the fetus or in infants. Robinson (34) says that he has always been able to find them in the newborn particularly in the pelvic colon where they first make their appearance.

The number of appendices epiploicæ present may vary within wide limits, but in round numbers an adult usually possesses about one hundred. While the appendices are arranged along the whole course of the large intestine they are most numerous in the transverse and pelvic colon. The cecum as well as the vermiform appendix may give origin to

them. They are absent from the rectum. To describe accurately their line of attachment to the large intestine one must recall that the longitudinal musculature of the entire colon is grouped into three bands or *tæniæ* one situated anteriorly the others postero-internally and postero-externally. In the transverse colon the anterior band becomes the superior often called the *tænia omentalis* the postero-internal the *posterosuperior* or *tænia mesocolica* and the postero-external the *inferior* or *tænia libera*. The appendices as a rule, are arranged in two rows one in relation to the anterior muscular band the other to the postero-internal. In some individuals there is only one row present whereas in others three have been observed.

The appendices epiploicæ have no definite form. They may be conical, rounded, or sacculated with a free dentated border or cylindrical with more or less of a fringed border and lobulated. Most of the descriptions simply classify them as of irregular form. In general they are either leaf-shaped with accompanying folds corresponding to their vascular supply or conical. They vary greatly in length and width. Their size varies with the habitus and state of nutrition of the individual. The conical ones are usually the longest and measure on the average 10 by 3 centimeters. Their weight too is not constant and has been found to vary between 5 centigrams and 1 gram. The combined weight of the appendices is only one fourth that of the great omentum (Robinson 34).

Histologically in addition to their serous covering and fatty content the appendices show a variable amount of reticular and elastic tissue and a few small blood vessels. The two layers of peritoneum comprising the basic structure of the appendices are separable and the potential sacs can be artificially distended with a fluid or air. It has been estimated that their capacity varies from 1 to 2 cubic centimeters. This distensibility is directly dependent upon their size. This phenomenon can be observed in pathological states.

The blood supply of the appendices epiploicæ is derived from branches of the superior and inferior mesenteric arteries which

enter at the bases and extend to the extremity of these structures (Hunt, 12). The veins follow the same course as the arteries and empty into the superior and inferior mesenteric trunks. Information concerning the lymphatic supply is lacking.

The appendices epiploicæ are in close relation to the segments of the large intestine from which they arise and the corresponding portions of the mesentery. Their intimate relationship to the three major lower abdominal apertures, the umbilical, femoral and internal inguinal rings is of clinical importance.

It seems probable that the appendices epiploicæ are in some manner related in function to that of the great omentum because of their similarity in structure. The sum and substance of our knowledge in spite of a large amount of experimental work upon this subject, seems to relegate the omentum to a protective or absorptive capacity. That the appendices epiploicæ may act in a like manner was recently called to my attention by two illustrative cases. In one an appendix epiploica was found adherent to and wound around a perforating appendix vermiformis in much the same manner that we often observe in the great omentum in these cases. Robinson (34) nevertheless has demonstrated experimentally that the introduction of fluids into the large intestine causes a rhythmic to-and-fro motion of the appendices and deduces that they are in some manner related to the absorption of fluids from this portion of the gut. While this view has not been substantiated it seems likely that the appendices, which are strictly limited to that portion of the gastro-intestinal tract the main function of which is the absorption of water may have the power to aid in this as well as in forming a protective barrier against the spread of intra-abdominal infection.

#### PATHOLOGY

The lesions incident to the appendices epiploicæ can be divided into the following groups:

1. *Mechanical interference* with the blood supply by direct pressure or torsion (a) within the abdominal cavity or in a hernial

sac: (b) formation of foreign bodies within the peritoneal cavity or in a hernial sac as a result of interference with their blood supply (c) torsion associated with and secondary to other inflammatory lesions of the abdominal cavity

2. *Infection of the appendices epiploicae* incident to or associated with interference with blood supply or to lesions of the corresponding segment of bowel wall (diverticuli)

3. *Adhesions of the appendices epiploicae* causing intestinal obstruction

Within the abdominal cavity torsion is perhaps the only lesion which may compromise the blood supply to these organs. Attached as they are by narrow pedicles along the whole of the colon it is easily understandable that the same factors producing torsion of other abdominal viscera such as ovary, omentum, intestines, etc. may result in a similar condition in the appendices epiploicae. The exact mechanism, however, is still unknown. Whether we believe with Morestin (24) that torsion only occurs in excessively long or large appendages or with Payr (30) that a disproportion between the artery and vein may be a determining factor suffice it to say that no unchallenged theory has as yet been proposed for those cases originating in the abdomen. That intra-abdominal adhesions to an appendix epiploica as the result of a previous inflammatory process may result in torsion has been brought to the fore by the case reported by Zocoppitz (47) where an omental adhesion was found attached to the extremity of a twisted appendix epiploica. But in this case it is barely possible that the adhesion was secondary to the torsion and not primarily a causative factor.

That torsion of the appendices may occur in conjunction with and be directly dependent upon other inflammatory lesions of the abdominal cavity recently presented itself to me as occasional explanation of this lesion in some cases. In one instance I observed a twisted and inflamed appendix epiploica wound around a perforating appendix vermiformis. In another torsion of an epiploic appendage in conjunction with an acute hemorrhagic pancreatitis. Whether the possible pro-

TECTIVE power adherent in these processes had resulted in a too sudden migration of the organ to the seat of disease with resultant torsion is difficult to ascertain definitely and admits of mere speculation. That it accounts for only a small number of cases is proven by the number of cases of torsion appearing in the literature where a careful exploratory operation revealed the twisted appendix as the only pathological finding. There are however two cases of foreign bodies the end result of torsion reported by Riedel (33) one subsequent to the removal of a gangrenous appendix vermiformis, the other associated with an acute inflammatory condition of the gall bladder.

Torsion in a hernial sac may occur as a result of one or a combination of the above factors particularly in a hernial sac of long standing, in which a chronic inflammatory process and adhesions of the contents to the sac wall incident to the use of a truss or repeated attacks of incarceration, are frequently found. Quite analogous to torsion of the appendices epiploicae in a hernial sac is the not infrequent occurrence of torsion of the ovary in strangulated hernia of young females when this organ appears as the sole content of the sac. Here the mechanism seems to be a twist imparted to the organ (35) in its passage through the internal inguinal or femoral ring and it is possible that the same mechanism may hold for torsion of the appendices epiploicae under similar circumstances. Other theories proposed have been those dealing with torsion dependent upon changes in intra-abdominal pressure due to peristalsis, contraction of the abdominal musculature etc. (Zocoppitz 47).

Torsion of the appendages may be sudden or gradual, each process resulting in a different clinical picture. The site of torsion, whether intra-abdominal or extra-abdominal (in a hernial sac) influences the symptomatology. Sudden torsion may manifest itself in a half turn through 180 degrees or in a complete twist through 360 degrees or even in ten half turns (case reported by Adler 1). The resulting changes in the appendages are dependent upon the degree and suddenness of the interference with their blood supply.

Sudden torsion may be accompanied by congestion of the enclosed fatty tissue with or without subperitoneal hemorrhage or the process may result in necrosis with complete gangrene. Gradual torsion of the appendages results in a chronic inflammatory process which may have much in common with ischemic fat necrosis described clinically and produced experimentally by Farr (8). The gradual interference with the blood supply of these organs is attended with a splitting up of the enclosed fat into glycerine and fatty acids with the production of soaps which later may become calcified. Farr (8) has also shown that the end stage of this fat necrobiosis may result in cyst formation which coincides with the findings in a case reported by Hunt (12) in which an appendix epiploica had become encysted and contained an oily straw-colored fluid. With the changes incident to deprivation in their blood supply due to sudden or gradual torsion these appendices are often cast off and lie free as foreign bodies (*corpora aliena*) in the peritoneal cavity or surrounded by omental adhesions. These bodies may vary in size from a pea to a hen's egg are most often rounded and may show evidence of their fatty composition or may become fibrocartilaginous or even calcified. One case is on record (Virchow 45) in which a corpusculum was encountered along with corroborative evidence of its origin from an appendix epiploica. In fact some have gone so far as to state that only with such evidence at hand can the origin of these bodies from the appendages be definitely determined inasmuch as calcified dermoids and old calcified echinococcus cysts may become free and appear as foreign bodies in the peritoneal cavity. Fox (9) and Neri (27) have attempted to produce these bodies experimentally.

What rôle does infection play in torsion of the appendices epiploicæ? Bland-Sutton (3) has demonstrated that the "fat content of the appendages is directly continuous with that of the subserous fat. It is readily comprehended that the formation of diverticula, which in some instances actually penetrate the bases of the appendices epiploicæ may particularly in the presence of infection,

lead to an implication of the appendages. McGrath (21) has shown the close relationship that exists between diverticula formation and the appendices, inasmuch as the latter are situated at the points of entrance of the large blood vessels into the intestinal wall, through which points of weakness herniation of the mucosa occurs. That infection of the appendices may result is well shown by the case reported by Patel (29) in which the lumen of an infected diverticulum penetrated the base of an epiploic appendage resulting in strangulation and infection of a left inguinal hernia. That the appendages may undergo inflammatory changes because of their close anatomical relationship to diverticula seems proven by the cases reported by Graves (10) but whether or not torsion is the result of this infection seems questionable.

#### CLINICAL FEATURES

Foreign bodies in the peritoneal cavity the end-result of torsion of the appendices epiploicæ, give no definite symptomatology unless infected when the symptoms and signs of peritonitis will be dominant (Riedel, 33). Some have been discovered during autopsies for intercurrent conditions others have given rise to vague abdominal complaints simulating gall bladder disease or have been found in laparotomies in conjunction with actual torsion of one or more appendices (two cases of Riedel 33). Sudden torsion of the appendices with or without infection results in sudden sharp abdominal pain, not necessarily limited to the seat of torsion. The pain may even be referred to the right side of the abdomen, when the torsion actually exists in an appendage of the sigmoid flexure (Harrigan 11). Vomiting, tenderness and rigidity—in short the picture of an acute surgical condition which is usually mistaken for an acute appendicitis, cholecystitis or diverticulitis—supervenes. The appendices may give rise to an intestinal obstruction, with the usual sequence of symptoms by becoming adherent to the parietes, or to the adjacent intestines, forming in this manner a ring through which loops of gut can become strangulated. Cases of this nature have been reported by Riedel (33) and by Hunt (12).

Intrahernial torsion of an appendage usually results in a sudden sharp pain in the inguinal or femoral region with an accompanying irreducibility of the hernial contents and the condition is usually mistaken for a strangulated hernia. Torsion in a hernial sac may occur without hyperacute symptoms (Muscatello 26) Strangulation of an appendix epiploica in the neck of a hernial sac is indistinguishable from any other type of strangulated hernia. The symptoms are however less severe than when intestines are compressed but differ in no way from those when the omentum is caught. So far as I know no case of either intra-abdominal or intrahernial torsion has been diagnosed pre-operatively. The treatment is of the twisted structure and ablation usually results in prompt relief.

#### REVIEW OF LITERATURE

The appendices epiploicae were first described by Vesalius later by Fabricius, Spiegel, Riolan, Glisson, Bartholin, and Willis (quoted from Robinson). Cruveilhier (6) in his work on pathological anatomy was the first to mention the presence of foreign bodies in the peritoneal cavity although Littre (18) in 1703 had previously published a case in the history of the Royal Academy of Sciences. Malgaigne (20) and Cruveilhier (6) were among the first to mention that an appendage might be one of the sole contents of a femoral, inguinal, or umbilical hernia. But to Virchow (45) belongs the credit of demonstrating the relationship between foreign bodies and the appendices. In his case the portion of the appendix remaining was demonstrated along with the foreign body which was attached by a narrow pedicle.

The literature to date contains twelve cases of foreign bodies in the peritoneal cavity the first reported by Littre (18) in 1703 to be followed by the case reports of Virchow (45), Schede (36), Cruveilhier (6), Laveran (16), Neri (27), five cases by Riedel (33) and one by Hunt (12). In these cases, with the exception of Virchow's (45) it seems probable that the foreign bodies had their origin in twisted and separated appendices epiploicae although no actual proof is at hand.

In all, there have been seventeen cases of intra abdominal torsion reported by the following: Tomellini (42), Riedel (33), two cases Briggs (4), Zoepfritz (47), Ebner (7), Pochhammer (31), Morestin (24), Kimpton (14), Hardigan (11) and six by Hunt (12) which comprised the cases observed in the Mayo Clinic for a period of ten years. A case also has recently been published by Black (2). To this number I desire to add two cases of intra-abdominal torsion one observed during a laparotomy on a case of acute gangrenous appendicitis the other in the performance of an autopsy, on a case of acute hemorrhagic pancreatitis. Although this lesion was not primarily one of torsion of the appendices, in one case the appendix epiploica had to be removed on this account for this reason I am including these two cases among those of intra-abdominal torsion.

Intrahernial torsion has been recorded ten times two cases by Riedel (33) others by Servé (38), Muscatello (26), Mohr (23), Lorenz (19), Krueger (15), Adler (1), Linkenheld (17) and Kenderdyj (13). To this number I am adding one case bringing the total of this type of lesion to eleven.

Intrahernial strangulation has been reported thirteen times, exclusive of the case reported by Patel (29) which appears to be a perforation of a diverticulum into the base of an appendix epiploica. These cases have been reported by the following: von Bruns (5), Muscatello (26), Schweinberg (37), Verga (44), Vulliet (46), Smoler (39), Linkenheld (17), two cases Tisserand (41), Truffi (43), two cases and Hunt (12) two cases. To this number I can add one occurring in a left femoral hernia. Inclusive of torsion and strangulation in a hernial sac or ring the lesion is more often located on the left side occurring in a left inguinal hernia seventeen times, in a right inguinal five times and in a left femoral hernia three times. Three cases of intestinal obstruction due to adherent appendices have been reported two by Riedel (33) the other by Hunt (12).

#### CASE REPORTS

CASE	Intrahernial torsion of an appendix epiploica
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M. G. (private patient of Dr. A. V. Moschcowitz) Hospital No. 5300 Patient male, age 5. For past year patient has had a hernia in the left inguinal region. On the night previous to admission he was suddenly seized with pain in the region of the hernia. Repeated emesis and much abdominal distention although his bowels had moved. Physical examination revealed an irreducible hernia in the left inguinal region which was very tender and painful. Pre-operative diagnosis, strangulated left inguinal hernia.

Operation, December 3, 19. Hernial sac exposed. It proved exceedingly difficult to be absolutely clear regarding the hernial contents. The peritoneum was finally opened just above the constricting ring. Exposure of hernial contents showed them to be two greatly hypertrophied, acutely inflamed epiploic appendages attached to the sigmoid flexure, one of which was twisted around its pedicle until it was almost completely detached. The appendix was removed and an Andrews-Bassini hernioplasty completed. Uneventful recovery.

Specimen showed an acutely inflamed and gangrenous appendix epiploica.

CASE 2. Intrahernial strangulation of an appendix epiploica.

S. L. (Surgical service of Dr. A. V. Moschcowitz) Hospital No. 30420 Patient, female, age 40. For past year patient has been aware of the existence of a left femoral hernia which had always been easily reducible until 24 hours previous to admission. At that time patient experienced pain and noticed that hernia was irreducible. No vomiting. Mass in the left femoral region was painful and tender.

Pre-operative diagnosis, left strangulated femoral hernia.

Operation, April 6, 1913. Sac of left femoral hernia was incised revealing a left epiploic appendage, strangulated in the femoral ring. Epiploic appendage removed with typical Moschcowitz repair of femoral hernia.

Specimen revealed hemorrhagic inflamed appendix epiploica.

CASE 3. Intra-abdominal torsion of an appendix epiploica.

31 R. (Surgical service of Dr. Edwin Beer) Hospital No. 30420 Patient, female, age 45. Chief complaint, pain in epigastrium and back for 4 hours. Examination showed an obese middle aged female with signs of a general peritonitis.

Operation revealed an acute hemorrhagic pancreatitis with cholelithiasis. Cholecystostomy and drainage was employed. Patient never rallied from the operation and died shortly afterwards.

Autopsy. In addition to the above operative findings, autopsy revealed a completely twisted and acutely inflamed epiploic appendage attached to the transverse colon.

CASE 4. Intra-abdominal torsion of an appendix epiploica.

A. H. (Private patient of Dr. A. A. Berg) Hospital No. 130743 Patient, male, age 43. Admitted with

a typical history and physical findings of an acute appendicitis. Operation revealed a completely gangrenous appendix vermiformis with a twisted epiploic appendage adherent and surrounding the perforating vessels. Epiploic appendage removed along with appendix vermiformis.

Specimen showed an acutely inflamed appendix epiploica.

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## THE EFFECTS OF RADIUM RAYS UPON THE OVARY

AN EXPERIMENTAL PATHOLOGICAL, AND CLINICAL STUDY<sup>1</sup>BY HARVEY BURLFSON MATTHEWS, B.Sc. M.D. F.A.C.S. BROOKLYN, N.Y.  
Associate Professor of Obstetrics and Gynecology, Long Island College Hospital

LAST year after reading before the Medical Society of the State of New York a paper on "The Use of Radium in the Treatment of Uterine Bleeding Other than Cancer" the question was asked whether or not the young women who received radium treatment for excessive uterine bleeding would be able to conceive and bear children following such treatment, and I was forced to answer that I did not know. Up to that time I had not made an intensive study of the subject from this standpoint and in reviewing the literature upon radium treatment of the conditions under discussion had not come across any treatise on this phase of the subject. During the past year however I have made a rather complete and comprehensive study of the effects of radium radiation upon the ovary. This study included some radiation experiments done upon rabbit ovaries, a pathological study of several human ovaries that have been exposed to radium, a collection of all the available cases of pregnancy following the use of radium from colleagues from all parts of the United States. From this data I have drawn several conclusions, which I believe are justifiable and which I trust you gentlemen will criticize constructively or destructively—as they deserve.

During the past 25 years radium has been used in many ways and in the field of medicine particularly gynecology it has assumed a most important place. That it is a therapeutic agent of real value there can be no doubt in the minds of those familiar with its action but the fact must be remembered that by this agent as by many others in medicine, great damage may be wrought by a lack of the proper understanding of its inherent activity. Its physiological action may become pathological, if improperly administered, and thus cause grave and irreparable damage to the body economy. Propagation and conservation of the species are an in-

herent part of life and if these functions are annihilated by the use of destructive agents directed toward the reproductive system, we as physicians are responsible.

The biological effects of all radio-active agents upon the sex glands when administered in sufficient quantities, is well known to be destructive. This phase of irradiation we should be particularly interested in, for by the improper use of these agents, we may destroy the power of reproduction in no small proportion of the younger generation of women who are constantly being radiated for abnormal uterine bleeding. Furthermore, there are many questions that we may ask ourselves regarding the subject under discussion. Some of them are the following:

1. What pathological lesions occur in the sex glands following exposure to radium rays?
2. Will the young woman who receives a therapeutic dose of radium directed upon her generative glands be capable of reproduction thereafter?
3. What proportion of women in the child-bearing age who have had radium treatment become pregnant?
4. How many abort, miscarry, have premature labor and how many go to full term?
5. What complications if any arise during the pregnancy or labor?
6. How many deliver a live healthy child? and finally
7. Does the child grow and develop in a healthy manner? This is a big broad and important problem, the solution of which has not as yet been entirely nor satisfactorily accomplished.

To begin with we have considerable literature accumulated upon the subject of the effects of radiation both X rays and radium upon the processes of development, including that of plants, infusoria, bacteria, many of the invertebrate and lower vertebrate animals, but there is a real paucity of data that

<sup>1</sup>From the Department of Obstetrics and Gynecology of the Long Island College Hospital, and the Hospital Laboratory of the Long Island College Hospital. Read before the American Gynecological Society, May 27, 1923, at New York, N.Y.



has to do directly with the effects of radium irradiation upon fertility in the human. It may be said however that the effects of X-rays and radium upon tissue in general are essentially identical depending in all instances upon the dose administered.

Redfield and Bright showed among other things, that seeds of various plants after exposure to radium rays fail to germinate as normal seed and that if such seed do sprout and grow the resultant plants are considerably below normal both in size and contour.

Iredell and Milnett, in various non-pathogenic and pathogenic bacteria found that radium radiation in small quantities did not retard their growth nor alter their cultural characteristics. A. B. Green, on the other hand, using relatively very large amounts of radium radiation e. g. 1 centigram of radium bromide screened to allow only B and C rays to pass, and placed 1 to 2 millimeters from the growth of bacteria—found that the non-spore-bearing bacteria were killed in from 2 to 5 hours exposure, whereas in the case of spore-bearing bacteria it required 72 hours or more of radiation to produce death. He furthermore found that after exposures of from 24 to 120 hours, micro-organisms themselves may after death, show signs of radioactivity. It has not been determined whether living micro-organisms can exhibit radioactivity or not, but micro-organisms that have been killed by exposure to radium emanations can do so. Pfeiffer and Friedberg, and Hoffmann also found that bacterial growth was retarded or totally destroyed by X-radiation or radium, depending on the amount of radiation administered and the screening used. Clinically these facts excite interest, for if radium emanations are bactericidal in action why not treat the infectious processes within the body with radium? Chemical agents are introduced into the blood stream for germicidal purposes, why not radium salts? Radium emanations are biologically destructive to all tissues and more particularly to certain types and while the same thing may be true for the various pathological micro-organisms causing sepsis, we know that massive destruction of vital tissues must end in death of the

organism and consequently sufficient radium emanations to destroy the infecting micro-organisms would undoubtedly destroy the life of the host.

Regarding the effects of irradiation upon the developmental processes in the lower animals we have a great deal of extremely valuable data (A. G. and H. Hertwig, Perthes, Reifferscheid, M. Fraenkel, P. W. Siegel, Danyas, Regaud and Lacaze, Baldwin, H. J. Bagg, and others). Not all of the information gained by the experimental worker however can be directly applied to the human because it is certain that a small animal—e. g. a rat or a guinea pig or rabbit—can withstand relatively a much larger dose of irradiation than a human can. Nevertheless, certain pathological states present in the tissues of the lower animals after radiation are certainly to be found in the human whenever the "dose" is relatively the same. Suffice it to say in this connection that all of these investigators found certain developmental retardations following irradiation of either the fertilized ova or the developing embryo at any stage of its developmental cycle. Furthermore they also found a particular susceptibility of the nuclei of the cells of all the tissues radiated and a general slowing down of the developmental processes especially in the central nervous system. The final morphological changes, depending upon the period of development when the radiation was applied resulted in monstrosities conforming more or less to a definite type (Baldwin). In general the effects of radio-active agents upon development are wholly dependent upon the dose administered, the amount of screening, and the stage of development. The earlier the radiation is applied the more deleterious are the changes that take place in the subsequent development of the organism. Embryonic tissues in general are far more susceptible than the corresponding types in the adult, for it has been conclusively shown that when certain parts of a very young developing animal have been exposed to a sufficiently large dose of radiation that part not only does not reach its normal size but fails to functionate properly. In any case there is always a latent period or

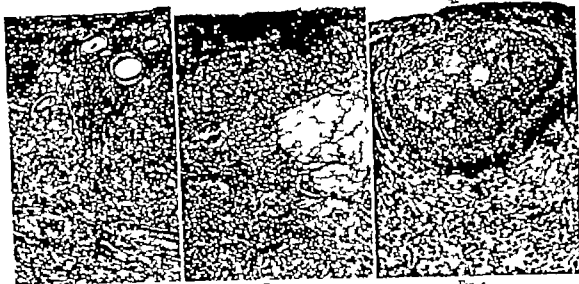


Fig. 1

Fig. 1 Photomicrograph showing section of normal rabbit ovary. Many primordial and ruptured follicles may be seen throughout the fibrous tissue cortex.

Fig. 2

Fig. 2 Photomicrograph showing section of rabbit ovary exposed 50 days previously to 500 milligram bromine radium (50 milligrams in 6 hours) with very few if any changes in the follicles, fibrous cortex, the epithelium cells

Fig. 3

of the ovary stroma, blood vessels, and corpus luteum. Fig. 3 Photomicrograph of rabbit ovary which 4 months previously had been exposed to 200 milligram hours radium (200 milligrams in 6 hours) left ovary. This rabbit was killed as found to be 10 days pregnant. The uterus contained 5 apparently normal young. Sections of these embryos will be studied.

a transforming stage through which all raved tissues pass before the final morphological changes take place. In other words there is always a varying lapse of time between the administration of any radio-active agent and its final effects upon the tissues exposed and, furthermore the larger the dose administered the more certain are these changes to take place and the more apparent the arrest in development becomes. Naturally there is a dose of radiation for any type of tissue or any form of life, beyond which life can no longer exist and therefore no developmental anomalies become apparent.

The biological effects of radio-active agents particularly X rays and radium upon the ovaries of many of the lower vertebrate animals—notably mice guinea pigs and rabbits—are fairly well known (thanks to the researches of such workers as Reifferscheid, M. Fraenkel, Danyasz Siegel, O. Hertwig, Regaud and Lacaze, and others from the continent, and Weiss and Maury in this country). The German and French literature is replete with such works but strangely enough

up to 1920 there was not a single article written in America upon this subject and even today there are only two such articles to be found viz. that of Maury 1920 and that of Weiss, 1923.

These investigators either working with the roentgen-rays or radium but usually with the former found that when an ovary is irradiated sufficiently there is found a round cell infiltration and engorgement of all the blood vessels, with later a marked deposition of fibrous tissue in and about the blood vessels and throughout the entire organ. The germinal epithelium is usually in a state of partial desquamation or is entirely absent. The follicles—both young and old—are particularly or wholly degenerated and filled with hyaline substance and swollen follicular cells with no ovule or egg cell present. The cortex may be entirely free of follicles and more or less densely infiltrated by fibrous tissue (Figs 1-8). All such changes are directly proportionate to the amount of radiation administered, the character of the screen employed and the distance from the



Fig. 4



Fig. 5

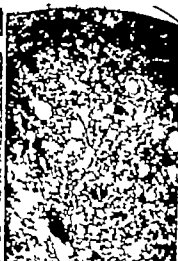


Fig. 6

Fig. 4. Photomicrograph section of rabbit ovary previously exposed to 200 milligram hours radium (200 milligram hours) showing some perfectly good follicles with germ cells and small vacuoles in the protoplasm and several large spaces in it probably the site of destroyed follicles and many smaller vacuoles through the epithelial matrix and led increase of fibrous tissue and about the blood vessels and throughout the cortex. The nuclei of the cells of the germinal epithelium can be distinctly seen but the cell outline can not. This rabbit could, in all probability in the course of time become pregnant.

Fig. 5. Normal right ovary of rabbit whose left ovary

had to die 5 years later exposed to 2400 milligram hours radium (200 milligram hours).

Fig. 6. Photomicrograph (20x) of section of left ovary of rabbit whose left ovary had previously been exposed to 2400 milligram hours radium (200 milligram hours). Section shows complete destruction of all follicles with more or less destruction of the epithelium.

1. Marked fibrosis throughout the entire structure of the ovary and marked rounded cell infiltration. The cortex is considerably thickened upon the periphery of each is seen the nuclei of the germinal epithelium. The clear spaces seen throughout the section represents destroyed follicles.

source of irradiation. The larger the dose the greater the pathological changes. Further more these characteristic changes do not take place immediately following radiation, but develop gradually and insidiously for varying periods of time— from 4 to 6 hours to as many weeks. Curiously enough if a given dose of radium has not been sufficient to destroy all the follicular apparatus of the ovary after a certain length of time depend-

ent upon the size of the dose the screening used and the amount of destruction produced fertility is again re established in the ovary. Rabbit A of this series of experiments received 1200 milligram hours over each ovary usually considered a sterilizing dose, in November 1922 and in March 1923 4 months later she escaped from her cage was covered by a neighboring buck and when killed 2 weeks later was 10 to 12 days pregnant. The cycle of events is obvious, viz

radiation a period of ovarian quiescence fertility re established followed by pregnancy.

I have checked up these statements in rabbit ovaries using radium and have found them to be correct. We developed young females who are known to have had at least one litter of young are placed dorsad on ordinary animal board (such as physiologists use for demonstration on live animals) the hair and fur were removed down to the skin a circular strip of ordinary kitchen linoleum, 2 inches wide encircled the flanks of the rabbit directly over the ovaries. The radium as firmly attached by small copper wires to the inner surface of the encircling linoleum as near as possible directly over and opposite the left ovary, the left ovary in every case being exposed. The radium placed in this position was never more than 3 to 4 centimeters from the left ovary and screened with millimeter glass, millimeter silver and millimeter brass—the same screening that are in the habit of using in the human, placed of course in the cervix and uterus. (See Figs 1 & 2 below.) The right ovary in some instances was removed before the left was exposed to radium. In other instances the right



Fig 7

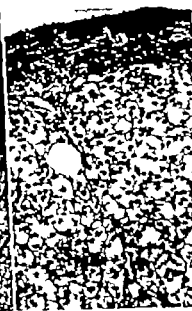


Fig 8



Fig 9

Fig 7 Photomicrograph, low power of same ovary as in Figure 6 showing in upper right hand section well preserved corpus luteum. At top of section there appears large space more or less filled with hemorrhagic material and cellular debris, which in all probability is the remains of destroyed graafian follicle. No signs of follicle of any kind. The outline of the epithelial cells are more or less destroyed and there is considerable fibrous throughout the entire structure.

Fig 8 Photomicrograph, high power section from same ovary as Figure 6, showing very much thickened fibrous cortex setting upon which may be seen the nuclei of the

germinal epithelium with no cellular outline. Throughout the epithelial matrix may be seen considerable cell destruction through which are interspersed many clear vacuolar spaces resulting from the destruction of the follicles.

Fig 9 Photomicrograph of section of ovary from woman 73 years old which had previously been exposed to 800 milligram hours radium (50 milligrams, 6 hours), showing marked edema of all the tissues, engorgement of all the vessels, many polymorphonuclear cells in the large blood spaces, and moderate rounded celled infiltration about the blood vessels (Signs of an acute inflammation).

ovary was removed at the same time that the exposed left was removed, and there seemed to be no difference in the normalcy of the right ovary (See Figs 4 and 5).

investigations that have been carried out in this connection have been upon the ovary.

Since 1903 there have been published many articles on the effects of the X ray upon the ovary but the results of the action of radium rays which we know to be almost identical with those of X rays, have not received so much attention, partly due to the cost of procuring the element and partly because of its scarcity. As a matter of fact, there is not a single article in English extant devoted exclusively to the effects of radium rays upon the human ovary.

From the human standpoint of this dissertation I have studied five irradiated ovaries. Mrs. C. age 27 years, received 800 milligram hours radium (50 milligrams, 16 hours intra-uterine) for uterine bleeding. Curettings showed early adenocarcinoma. panhysterectomy done 8 days later (See Figs 9 to 13 inclusive).

In gynecological radium therapy there is not available, at the present time a single practical biological method to measure the effects of the various rays upon the ovary. A study of the biological reaction of all tissues to radium irradiation is, it would seem, the only way in which we can evaluate its effects. From each study will be gained some idea as to the quality and quantity of rays used and thus, finally the therapeutic "dose" will have been established for each type of tissue and each pathological lesion.

Of special interest to us are the studies that have to do with the female reproductive system in general and the sex glands in particular. In fact most all of the histo-anatomical in



Fig. 9



Fig. 10



Fig. 11

Fig. 9 Photomicrograph, high power, from same ovary. Figure 9 showing same conditions. Polymorphous elements may be seen more distinctly.

Fig. 10 Photomicrograph, high power, section from same ovary as Figure 9, showing more clearly the colostrous state of the blood vessel. (Fig. 10)

Fig. 11 Photomicrograph, high power, section from ovary of woman, 7 years of age, same as Figure 9, showing several primordial follicles which apparently have not been destroyed by the 800 milligram hours exposure (50 milligrams 6 hours).

Mrs. M. age 36, received 50 milligram hours radium (75 milligrams 30 hours intra uterine) for uterine bleeding. 7 weeks later bleeding had not been controlled, partial hysterectomy done. Examination of specimen shows chronic metritis, thin marked polypoid endometritis (precancerous). The effect of the radium is shown. Figures 14 to 15 include.

Mrs. S. age 40 years, menstruating regularly at the time of first examination showing early epithelioma of the posterior lip of the cervix with slight exudate. Subsequently received 4000 milligram hours radium (600 milligrams 40 hours intra uterine). Initially she did not menstruate again. She as followed long in the dispensary and 4 months after her original irradiation there was noticed recurrence in the posterior lip of the cervix. The uterus remained small and the parametria at this time were perfectly movable and apparently not infiltrated. Wide complete hysterectomy was decided upon and done at once. The effect of 4000 milligram hours of radium upon the ovaries may be seen in Figures 16 to 20 include.

I show the similarity in the results of very large doses of radium—4000 or more milligram hours—16 included section of typical atrophic ovary removed from woman 60 years old, who had not menstruated for over 20 years (Fig. 21).

It has been shown that the most vulnerable part of the ovary is the graafian follicle (Fig. 13) the primordial follicle escaping injury long after the mature follicles have been

disintegrated (Fig. 12). The germinal epithelium and corpus luteum being the most resistant are the last to be destroyed by irradiation (Figs. 17 and 20).

There is found after the usual therapeutic doses of radium e.g. between 800 to 1200 milligram hours, a round celled infiltration, engorgement of all the blood vessels (Figs. 9, 10 and 11) a fibrosis in and about the blood vessels, and a general fibrosis throughout the entire organ. Where the dose of irradiation has been sufficiently large e.g. 2400 to 4000 milligram hours there is complete destruction of the follicular apparatus with an extreme fibrosis in and about the blood vessel amounting in some instances to an obliterative endarteritis (Figs. 18 and 19). In such cases there is an extreme fibrosis throughout the cortex and medulla with complete destruction of the germinal epithelium and corpus luteum. There is further more marked hyalinization of the fibrous tissue replacing the cortex, so that about the periphery of the ovary for varying depths there is practically no cellular elements to be seen. Likewise the destroyed follicles are replaced by hyaline material together with



Fig 13



Fig 14



Fig 5

Fig 5 Photomicrograph moderate high power (340 $\times$ ) section from same ovary as Figure 9, showing degenerated graafian follicle containing much degenerated follicular epithelium, hyaline material, and cellular detritus—practically complete destruction.

Fig 14 Photomicrograph of ovary of woman 36 years old which had been exposed to 30 milligram hours radium (75 milligram, 30 hours intra uterine) for essential

or idiopathic bleeding 5 weeks later as hysterectomized because bleeding had not been controlled. Section shows considerable round celled infiltration, large degenerated follicle and there is considerable edema. (Low power.)

Fig 5 Photomicrograph (20 $\times$ ) section from same ovary as Figure 14, showing one large degenerated follicle filled with hyaline material and cellular detritus, considerable round celled infiltration, and considerable edema.

masses of cellular detritus. Many primordial follicles, after the usual dosage, are not destroyed but remain imprisoned in the resultant tough hard fibrous tissue and hence cannot easily grow to maturity and rupture thus causing a temporary period of amenorrhea. A follicle thus destroyed can not be recovered and therefore we have no temporary atrophy succeeded by complete ovarian regeneration as was once thought to be the case. Indeed it is absolutely incorrect to speak of ovarian regeneration for the ovary during its extra uterine life can develop and gradually shed only such follicles as it possessed at birth and when these follicles shall have perished there can be no others forthcoming. Sterility is the final result.

Since the cells of the corpus luteum are remarkably resistant to irradiation and their existence thereby prolonged we may conclude that at least part of the internal secretion of the ovary is thus preserved for the menopause phenomena, even after complete sterilization are not as severe as after total surgical ablation. Thus the histo-pathological findings and the clinical picture coincide and justify the assumption that the radiation menopause is less severe than the surgical

There is evidence from animal experimentation and clinical experience to show that abortion is, to some degree at least more frequent following irradiation. Naturally the quantity and quality of irradiation will determine the likelihood of impregnation. The earlier the pregnancy the more sure are the deleterious effects of radium rays upon the offspring and the more apt abortion is to take place.

In the first instance the radium rays as is well known act upon the embryonic tissue directly and oftentimes cause serious degenerative changes resulting in abortion where as in the second instance the action of the rays is upon the corpus luteum of pregnancy destroying it and thus causing abortion to take place. Again abortion may be caused by an effect upon the unripe follicles previously rayed but not to the degree of destruction. Such follicles thus hampered, progress to maturity become fertilized, and pregnancy results. Such a pregnancy may in the very early stages, be aborted, due to the injurious effects exerted by the radium rays upon the follicle that was responsible for this particular pregnancy (Aschenheim, Werner, Steiger, M. Frankel, A. Mayer).



Fig. 6



Fig. 7



Fig. 8

Fig. 6 Photomicrograph, high power section from same ovary as Figure 4, showing marked increase in fibrous tissue; and about the blood vessels marked round cell infiltration with edema throughout all the section.

Fig. 7 Photomicrograph, high power section from same ovary as Figure 4, showing marked germinal epithelium, the nuclei of which are fairly well preserved but some cellular outline cannot be made out.

Fig. 8 Photomicrograph (30x) section of ovary of

woman 40 years old, previous exposure to 2000 milligrams linear radium (30 milligrams, 40 hours intra uterine) for early epithelioma of the cervix. Hysterectomized 4 months later. Section shows marked round cell infiltration with fibrosis in and about the blood vessels, which amount in many places to an endarteritis with extreme fibrosis throughout the entire ovary especially the cortex. No follicles and the remains of follicles can be seen after study of mass of these sections.

In the series herein reported of 39 pregnancies following the irradiation by radium of 874 women in the child-bearing age, there occurred 22 normal labors, and 15 abortions or miscarriages thus making the ratio of abortions to normal labor as 1 to 2.6 whereas in Germany the ratio of abortions following X-ray and radium treatment was as 1 to 2.3 in 1512 cases (Werner). The estimated ratio of abortions to normal pregnancies in the United States is as 1 to 3 or 4 whereas in Germany it is as 1 to 5 or 6.

Regarding the pregnancies resulting from the ova that became fertilized and were not terminated by abortion, we furthermore have ample evidence to show that normal progeny is the result. In our series we have the follow up notes of 5 of the 20 normal babies that resulted from our reported 39 pregnancies whose ages now range from 2 to 5 years and whose general health has apparently remained within normal limits.

In Werner's series of 25 pregnancies from 1512 rayed cases, there were 14 normal children born and 10 of these were continuously followed up during their subsequent development—from 2 months to 8 years. Their development was normal generally except 2 of these children were slightly subnormal in both weight and length in comparison to other children of the same age. This fact, however cannot be said to be entirely due to the effects of radiation upon the follicle that was responsible for these respective children. Indeed, there are many conditions that inhibit normal development in all children—rich and poor alike.

The effects of irradiation upon the embryo is an entirely different matter and there can be no doubt but that very serious developmental defects occur following irradiation during the pregnancy state. And, as stated above the earlier the radiation is employed the more surely will developmental defects result. The amount of irradiation given and the method of screening will determine, in each instance the extent of the final deformity which according to Baldwin, Bagg

I think only fair to state that the question in the non-irradiated ovary and uterus in the child was and still is as properly as the other conditions, which accounts for the small number of children from this series. I feel sure there were many more children just as well and healthy as the five reported.



Fig 19



Fig 20



Fig 21

Fig 19 Photomicrograph, high power section from same ovary as Figure 8, showing blood vessel which has been closed by extreme formation of fibrous tissue (this is all endarteritis).

Fig 20 Photomicrograph (120) section from same ovary as Figure 9, showing a completely preserved corpus luteum, bearing out the statement that the corpus luteum is one of the last elements of the ovary to disappear under the influence of radium. Note also the many blood

vessels which are closed or have only small lumens remaining.

Fig 21 Photomicrograph (120) section of corbatic ovary of woman 60 years old, showing many of the characteristics of the ovary (Fig 9) which has been exposed to 4000 milligram hours radium. Notice extreme fibrosis in and about the blood vessels, many showing a true endarteritis, and the extreme fibrosis throughout the entire ovary.

and others is directed particularly toward the central nervous and reproductive systems, although any part of the embryo may show pathological changes. Such morbid changes must be due to an unequal effect on the various biological processes which go on side by side in the process of development, for otherwise the entire embryo i.e. all the tissues of the embryo would show an equal effect. A knowledge therefore of the selective action of radio-active agents becomes of vital importance to the clinician who expects to adopt their use.

There is considerable evidence both experimental and clinical to show that age plays an important rôle in the final effects of irradiation upon the ovary. M. Frankel showed that when a young active animal's ovaries were rayed with a sufficient dose of X-rays to produce sterility in an older adult animal the ovaries of the younger animal were stunted in their growth, but were not rendered sterile. Such animals were bred and normal progeny resulted. Clinically it is certain that young, healthy women are sexually more active than their older sisters, for it is a well-established fact that ripened

follicles are more sensitive to irradiation than unripe follicles. Therefore, it should require larger doses permanently to destroy the follicular apparatus of younger subjects, everything else being equal than it does in older women who have fewer and less resistant follicles. Not all ovaries, irrespective of age of the patient react to irradiation in the same manner. Some are more and others are less susceptible to the action of the rays e.g. Mrs. B. a young woman, 23 years of age, bleeding from fibroid uterus was given 1200 milligram-hours radium. Amenorrhoea of 21 months duration followed, after which menses became regular. In contrast Miss S. 30 years old, bleeding with excessive menorrhagia and metrorrhagia for 4 years with no demonstrable pelvic pathology, covering a period of 18 months was given 4,650 milligram hours radium. After 3 months amenorrhoea menstruation began and has continued for 2 years.

#### CONCLUSIONS

From this study the following conclusions may be formulated:

1. Ovarian tissue in certain of the lower vertebrate animals, notably the rabbit, can





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## OVARIAN IMPLANTATION

THE PRESERVATION OF OVARIAN FUNCTION AFTER OPERATION FOR DISEASE OF THE PELVIC VISCERA

B. W. LESTER, J. AB MD FACS BETHLEHEM, PENNSYLV.

THE devastating effects of grave pelvic inflammatory disease have long been a trial and a problem to the surgeon. The fallopian tube being the site of the most extensive inflammation is usually badly crippled its function is destroyed and the path of the ovum from the ovary to the uterus is interrupted or blocked. The obvious result is sterility of the individual. That this condition occurs often in young women from innocently acquired gonococcal infections after a single pregnancy or before any is a further distressing factor. In treating the simple acute stage, mere palliative measures, such as rest, douches, and local heat may often be attended with success and the patient makes an excellent recovery. In the chronic recurrent, or subacute type however with persistent invalidism or ill health and extensive damage to the tubes, some radical procedure is necessary—bilateral salpingectomy leaving one or both ovaries, with or without resection of a portion of the fundus of the uterus (Polak, 16). In very extensive lesions, transplantation of a portion of an ovary may be advisable. There may be return to good health, and menstruation is preserved but sterility is practically certain.

Empirically satisfactory surgery in chronic pelvic inflammatory disease must contemplate an operation whereby (1) the disease is eradicated, (2) menstruation is preserved and (3) the possibility of pregnancy still exists.

Fortunately seldom are the ovaries, or both ovaries, involved in this disease usually one can readily be saved. Bilateral salpingectomy will remove the diseased tissues the uterus may be kept intact so that menstruation may be retained. The peculiar difficulty therefore lies in arranging that the ovum extruded by the ovary shall be able to enter the uterus.

Conservative efforts to preserve the possibility of pregnancy in this disease date from 1895 when Robert Morris (13) reported an operation in which, after radical removal of the tubes and ovaries, an attempt was made to obtain pregnancy by transferring or grafting a piece of ovary to the interior of the stump of one oviduct. A healthy portion of the patient's supposedly diseased ovary was used. Apparently one month later the patient did become pregnant and aborted at the end of the third month. No anatomical examination of the material was possible.

Frank (9) in 1898 recorded three cases in which one tube and ovary and the major portion of the other tube, were removed, and a portion of the remaining ovary was implanted into the stump of the tube and menstruation was preserved.

In 1900 A. Palmer Dudley (6) described an operation in which the fundus of the uterus was sectioned and an ovary still attached to its pedicle was placed in the cavity of the uterus "dangling like a polyp." The opening in the uterus closed about the pedicle. The remaining ovary and both tubes were removed. The patient menstruated immediately later had a questionable period of amenorrhea, and apparently aborted after 2 or 3 months.

In 1903 the first of Dr. Franklin H. Martin's exhaustive papers (10, 11, 12) on "Ovarian Transplantation" appeared. He devised a very ingenious operation for a young woman from whom both tubes and ovaries had been removed, grafting healthy ovarian tissue from another woman into the remains of the broad ligaments, and doing a plastic operation upon each uterine horn to make a new peritonealized opening into the uterus. His first case menstruated regularly for at least 2 years; a similar operation in a second case after a sporadic show failed to

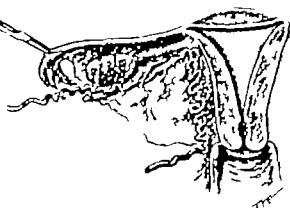


Fig. Anastomosis of uterine and ovarian arteries.  
Blood supply of ovary.



Fig. Excision of tube and its insertion in the uterus.  
Lumen of stump shown by dot.

menstruate apparently pregnancy occurred in neither case.

In 1906 Morris (14) again reported that 4 years after operation a baby was born to a woman whose ovaries he had removed transplanting those of another into the broad ligaments, the tubes being normal.

In 1911 Ulfreduzzi (20) concluded from experimental work on rabbits and guinea pigs, that "with implantation of an ovary or piece of ovary *into* the uterine cavity projecting into the cavity or *in* the uterine cornu, pregnancy cannot occur. An ovary transplanted into the uterine wall is very quickly excluded from the cavity and is unable to ovulate directly into it." (Quoted by Chalfant, 5.)

Storer (17) in 1915 cited a case upon which 4 months previously a bilateral salpingectomy and unilateral oophorectomy had been done. He operated again, divided the horn of the uterus, and split the remaining ovary leaving each half attached to the pedicle. One-half he implanted in the horn of the uterus which was closed about it. The remainder was allowed to remain *in situ*. Pregnancy with abortion at 3 months eventually followed.

Recently Bainbridge (2) has reported a case operated upon in 1905 in whom both tubes and ovaries were removed except one small bit of ovary which was entirely freed and grafted at the stump of the tube in the cornu of the uterus and covered with an

omental flap. Four months later the patient, 39 years of age menstruated and one and a half years later had a normal labor and bore a healthy child. She continued to menstruate until 51 years old when normal menopause occurred.

Bainbridge (2) in suitable cases has also been grafting ovarian tissue into the slit fallopian tube or into the stump of one or both tubes, covering them with omental grafts.

Dr Robert Morris (15) has likewise suggested the sparing of the remaining oviduct whenever possible, in cases where one tube and ovary have been removed. He simply slits the tube its entire length and drops it back in the pelvis believing that in 3 or 4 months it will recover sufficiently to function.

In an attempt to find a method whereby pregnancy could take place after bilateral salpingectomy the following operation was evolved by my father in 1904 and 1905 reported in 1909 (7) and again in 1921 (8). It has been used in our clinic in selected cases to number now about 100.

#### OPERATION

With the patient in the Trendelenburg position and the upper abdomen packed off pelvic adhesions and the tubes and ovaries are carefully and gently freed. The ovaries



Fig. 3. Resection of ovary less than area the size of the raw surface of the uterus horn. A, Diagrammatic illustration of raw area of ovary sutured to the raw area of the uterus. B, Diagrammatic illustration of the raw area of the ovary sutured to the raw area of the uterus.

are thoroughly inspected and the one most normal in appearance is chosen for implantation. The other may likewise be saved if its condition justifies it. In the great majority of cases it must be sacrificed.

1. The tube and ovary of the side opposite the implantation are first removed. The broad ligament and the uterine artery where it emerges at the horn of the uterus, are tied off. The operation is not completed on this side until the implantation has been done (Fig. 5).

2. The tube of the implanted side is then removed together with enough of the horn of the uterus at the tubal attachment to leave a raw area the size of the cut surface of the ovary. Care is taken to preserve the anastomosis of the uterine and ovarian arteries (Fig. 1). In the center of this surface will usually be seen the opening into the uterine cavity less than one quarter of a centimeter in diameter or the size of the heads of two ordinary pins (Fig. 2). There will be slight oozing but it can be readily controlled by pressure after ligation of the uterine artery just below the operative area.

3. A longitudinal slice is then taken through the full diameter of the ovary removing usually about one quarter of it from the surface opposite its ligament and mesentery (Fig. 3). The amount of ovary removed depends upon the amount of cystic degeneration or inflammation that may be present. We have removed as high as seven eighths



Fig. 4. Below suture of round ligament over implanted ovary. Above same suture completed.

of the ovary and have implanted the remainder.

4. The cut surface of the ovary is then turned over upon the denuded area of the uterine horn and sutured in place by a continuous catgut (chromic No. 0) beginning at the inferior margin and approximating the complete circumference of the ovarian and uterine wounds (Fig. 3 inset).

5. The round ligament is then plicated over this entire area by suture to the uterus to cover and completely peritonealize it (Figs. 3 and 6).

6. On the opposite side the stump of the broad ligament is sutured to the horn of the uterus and in turn, like the implanted area covered by the round ligament. A cul-de-sac drain, if indicated, may then be inserted. The abdomen is closed without anterior drainage.

The cases are selected with respect to (1) age (2) social status (3) condition of the

uterus, and (4) stage of general pelvic inflammation

1 The operation has been performed on patients whose ages ranged from 18 to 39 the average age being 27.7 years. Young women below 30 years of age were usually chosen because in the older women there is less desire for pregnancy and less likelihood of pregnancy occurring.

2 Women of low mental caliber or of questionable character obviously should not be given the opportunity for future pregnancy.

3 A very oedematous uterus which is evidently involved in the inflammation is considered a contra indication.

4 No plastic operation is attempted if there is present a large pyosalpinx or pelvic abscesses.

We have had no mortality from this operation.

#### PND-RESULTS

We have attempted to investigate 88 cases. We have been able to obtain completed returns in 27 only. It is apparent that the great majority of the women who have undergone this operation are of the laboring class with its well known rapid turnover and restless wandering. It is, therefore, scarcely justifiable to consider the following data as much more than a preliminary report.

1 *Operative notations.* A. Cultures were in general sterile. gonococci were found in one case. colon bacilli in one case. There were three cases of tuberculous salpingitis. The vast majority of the cases reported sterile were considered old chronic gonococcal infections.

B. The left and right ovary were used about equally for the implantation of 40 cases, the right was employed in 20, the left in 19, and both ovaries in 1 case.

2 *After-history.* A. *Pregnancy.* Pregnancy after operation occurred in four cases (15 per cent of 27). There were two cases of full term pregnancy, both children are living and are normal in every way. In one the complete record is not available but she had had no pregnancies before operation. In the other the woman age 30 married 3 years who had never been pregnant was operated upon for tuberculous salpingitis and im-



Fig. 5. Diagrammatic resection of tube and ovary on the side opposite the implantation.

plantation done on August 12, 1916. The baby was born on July 19, 1921; delivery was normal. Both mother and child have been quite healthy since.

Two women had miscarriages at about 3 months. In neither case was any specimen available for corroborative examination. None of these four women has had more than one child or pregnancy.

B. *Menses.* Menstruation was regular with usual duration and pain in 19, 70 per cent. Irregular in four, either profuse or scanty in three. The report was insufficient for accurate deductions. Only one case failed to menstruate, a woman of 37 in whom only a small portion of the ovary was saved.

C. *Pain.* Seven, or 25 per cent, complained of some pain, usually worse with menses, either headache, backache, or pain in the same side as the implanted ovary.

D. *Nervousness.* Ten, or 40 per cent, of these 27 acknowledged that they often felt "nervous." One, about a year after the operation, developed symptoms of hyperthyroidism. Of the 27 cases, 14 had been pregnant before operation, 13 had never been.

E. *Subsequent operation.* Three, or 11 per cent, had sufficient discomfort or subsequent pain and disability to require another operation. A cystic enlargement of the implanted ovary was found in 2. There was no definite information as to the third, but a similar condition probably existed.

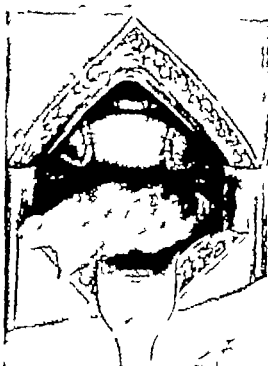


Fig. 4. Operation completed. Both uterine horns covered by the remaining omentum.

#### DISCUSSION

In the consideration of pregnancy following an operation of this character due regard must be paid to the possibility of pregnancy occurring after the removal of both ovaries, or both tubes and ovaries alone. Baldwin (4) has reported two cases in which pregnancy occurred after both ovaries had been removed and the tubes allowed to remain and suggests that adventitious or accessory ovarian tissue was still present possibly intraligamentous. In the discussion of Bainbridge a paper both Habcok (1) and Tracey (18) cite instances of pregnancy that had followed removal of both ovaries and also removal of both tubes and ovaries. However 4 cases of pregnancy following a deliberate attempt to obtain it, seem to raise this procedure out of the realm of accidental coincidence especially as in 3 pregnancy had never occurred before.

If pregnancy occurs following implantation it must be because the surface of a graafian

follicle comes in contact with the opening of the tube and heals in this position so that when the follicle ruptures, the ovum can enter the tube.

Therefore as the graafian follicles are in the cortex a higher percentage of pregnancies may follow this operation if care is taken to remove either a thin layer of the surface or fully seven-eighths of the entire ovary so that the ovary is sectioned through the cortex and a cut section of cortex and follicles is implanted upon the uterus and tube opening. In case most of the implanted ovary is sacrificed, the other if possible had best be saved to insure menstruation.

#### SUMMARY

An operation is described for implantation of an ovary upon the horn of the uterus which may be followed by menstruation which is usually normal in character. pregnancy may follow. There may be pain in and about the implanted ovary or rarely the ovary may become cystic and require subsequent removal.

#### CONCLUSION

Tufts (19) well known work on "Transplantation" has since 1910 rather dominated the field as the preservation of menstruation seems of more vital importance than the possibility of pregnancy. It is desired however in this report to direct attention to the possibilities of conservative ovarian implantation and the opportunity it affords for permitting pregnancy as well as maintaining menstruation.

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# DEPARTMENT OF TECHNIQUE

## PROBLEMS IN TREATMENT OF CARCINOMA OF THE BREAST

By HOWARD A. KELLY, M.D., F.A.C.S., BALTIMORE, MARYLAND  
Professor Professor of Gynecology in the Johns Hopkins University

AND  
ROBERT L. FRICK, M.D., B. THORPE, M.A., LL.

AS expert surgeons we have waged war for many years against a relentless foe—malignant disease of the breast, a form of cancer so prevalent and with an onset so insidious that too often our most aggressive measures fail to cure, and this in spite of the recent rapid strides in surgery in other directions. Selecting the most favorable operable cases, with the cancer apparently confined to the breast tissue only, Halsted and Deaver have quoted 80 per cent as cured by operation; on the other hand, where the disease has demonstrably extended into the axillary glands, our surgical intervention succeeds in curing from 12 per cent (Greenough) to 43 per cent (Furstenberg).

Radium therapy has come recently to hold out a legitimate promise of becoming at least our most valuable adjunct to surgery, and it is now our important task to develop the technique of the applications, raising them to the same effective plane as that of our present surgical methods.

### EARLY OPERABLE GROWTHS

Lying at a target hidden behind a bush is always a serious handicap the intervening foliage obscures the bull's eye and lessens one in doubt regarding the best caliber of bullet, the most effective distance, and the number of shots necessary for a perfect score. In the same manner, when there is an incipient carcinoma in the breast without tangible glandular metastases, it is impossible to predict the extent of the disease, and for this reason we are hampered in the accurate focusing of our x rays and in delivering an effective dosage in all possible affected areas. Hence surgery properly takes precedence over radium therapy in all good operable risk.

The surgeon removes the bush which screens the lurking disease and the disease itself as far as possible. Later local recurrences are fortunately

obvious and offer a superficial target which radium can usually obliterate.

Since Cullen, Clark, and others, by their splendid propaganda in medical and lay magazines, have posted the public about the dangerous potentialities of any lump in the breast, we find in common with other surgeons that many cases come earlier for diagnosis and treatment.

Our own technique followed for many years past is in all cases to examine the breasts with minute thoroughness, including the axillary and the supraclavicular areas. Then we take an x-ray plate of the chest uniformly in all the cases, as first suggested by Curtis F. Burnam; it is pertinent to remark how often patients unexpectedly show pulmonary or mediastinal involvement even with a small breast lesion. If the patient proves a good operative risk, a radical breast and gland enucleation is the immediate imperative step. In cases of doubtful malignancy the breast nodule is first excised and the tissue sectioned, stained and examined at once during the operation. It is too little known that this practice of immediate sectioning, staining, mounting, and examining originated in my clinic with Dr. T. S. Cullen. As a rule the diagnosis is so clearly made that the section is filed and considered sufficient for the permanent record. If malignancy is found, the radical operation is proceeded with. I cannot urge with too great importunity the advisability of operating upon every doubtful case; the natural inclination to observe the uncertain case has cost many a life even in the best hands.

About 10 days after the operation a heavy radium treatment is given in an effort to destroy any cancer cells left behind by the knife, five or six equidistant portals being chosen along the line of incision and a gram at one-quarter of an inch filtration applied for 10 to 12 minutes to

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Fig. 11 T. Thorax graph taken November 29, 1919, shows how completely the breast has almost disappeared.

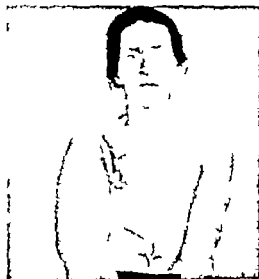


Fig. 11 T. Condition of chest in January 1923.

such spraying methods are not of the lightest avail in eradicating it.

#### INOPERABLE CASE

Had operative risks, and patients no relief operation, and cases in which the growth has metastasized to the neighboring glands or to the mediastinum, vertebrae or ribs, or those preventing recurrences after operation, having been left as their one hope. In this group it is obviously as useless to radiate pulmonary metastases, as it is to operate. Metastases to the spine on the other hand, are often helped in a remarkable and unexpected manner by heavy treatments, which serve to alleviate the pain and often enable the patient to live a year or two longer in comparative comfort. In some of our patients in this group there has even been an evident deposition of new bone with resumption by the patient of the normal relations in life almost a resurrection.

Large inoperable breast cancers can be heavily radiated without injury to the skin by the implantation of tiny glass specules (also called "points" and "seeds") containing radium emanation in addition to the external applications. Treatment here alleviates pain as well as retards ulceration and sloughing of the tumor. Sometimes there takes place a marvelous *resistance ad integrum* so that the whole area presents the appearance of undergoing complete resolution. The end in this group though often delayed is

each. Also the axilla and supraclavicular spaces are radiated going at 2 inches the equivalent of 5 or 6 gram for an hour. Application of radium to the neck and to the axilla demands great care; the package must be adjusted accurately and the surrounding skin protected with heavy lead, a precaution which as well as protecting serves to prevent slipping of the lead on one side or the other—an accident which might result in a severe burn. Just as a surgeon develops an aseptic conscience so must the radiologist acquire a strong protective instinct. On completing the treatment outlined above the patient is discharged but with strict injunctions to be kept under observation at increasing intervals of time for several years, and treated with radium if there are recurrences. The value of general mere prophylactic treatments is more than doubtful.

Some advocate a general radiation of the breast preliminary to operation, also of questionable utility for it is certain when disease once appears

always lethal on account of the metastases. Re current nodules on the chest wall, usually lentil in form disappear a by magic under proper dosage. We had one of these massive cases sent to us by Habstedt about 8 years ago where he found it hard to accept the evidence of his own eyes in the face of facts so utterly controverting all his previous extensive experience.

Radium treatments of inoperable growths are always painless. The effect is to alleviate pain, to prevent ulceration and sloughing, and to give the patient a year or more of life. Better results still may be looked for within the next few years from improvements in the technique of administration.

### CANCER CURES

Another of the problems of the radiologist is the proper treatment of patients who have been deprived of all their chances by cancer quacks using salves and pastes, a literal slow assassination. The following is illustrative.

Mrs. H. T. of Jacksonburg, West Virginia, age 47, entered the Howard A. Kelly Hospital, November 29, 1919. She had noted a lump in the right breast and another under her right arm a year and half before admission. Some radium and X-ray treatments were given in Columbus, Ohio, without obvious improvement, so she drifted to the hands of notorious cancer specialists in Kansas City. In June 1912, by daily application of black paste she removed the right breast—but, unfortunately did not touch the axilla, the important seat of the disease. Examination on admission showed that her condition was utterly hopeless: the entire right axilla formed rigid, carcinomatous masses, and there were multiple nodules about the clavicle. The photograph taken November 29 (Fig. 1) shows how completely the breast had sloughed off, neglecting the cancer above. An X-ray plate of the chest here was negative. Measurement through the chest above the line of the breast was 35 centimeters on the right side compared with 75 on the left. The right arm was greatly swollen, the upper arm measuring 35 centimeters in circumference and the forearm 26 centimeters in comparison with 26.5 centimeters and 20 centimeters at corresponding levels for the left.

Palliative radium treatments were given to the right anterior axillary fold and the right supraclavicular region, giving some relief. By the middle of January an ulcer had appeared on the scar on the right chest; the growth had increased in the axilla and the right neck; the edema of the arm had increased so that the measurements of the right arm were 39 and 34.5 centimeters (Fig. 2). This edema as relieved by a Kosloff operation performed January 3, 1921, joining the superficial and deep lymphatics of the arm with wide excision of the fat fascia, and pectoralis along the entire outer median surface of the arm.

She died April 25, 1923.

Quackery is not confined however to the application of pastes and salves. Radium in the inexperienced hands of regular doctors is a form of quasi-quackery just as dangerous; the knowledge of proper dosage is only acquired by patient



Fig. 3. Case N. S. B. Skin irritation from heavy radium dosage.

endeavor and the closest study of results of treatments. All the larger radium hospitals are glad to instruct visiting doctors in problems of radium dosage. Too light a treatment stimulates the growth and also loses valuable time; too heavy a dose produces a burn, breaks down healthy tissue and destroys resistance. The following instance illustrates the result of misdirected effort: two years ago a patient entered the hospital with the ensuing history.

A radical operation for breast carcinoma had been followed within a few months by an axillary recurrence. The surgeon then told her that further operation was not indicated, but that radium therapy might help. The patient consulted the doctors of a radium corporation. Their method of treatment consisted of the daily injection of cubic centimeter of solution of radium into the veins of the arm. She endured this treatment for months, not knowing naturally that daily injection of common salt solution could have had an equal effect on the growth. When seen here the loss of time had precluded all chance even of relief, and she was in great pain, carrying her enormously swollen arm on a pillow supported by slings.

### CASES BENEFITED BY OPERATION AND RADIUM

Now let us consider a group in which favorable response to operation and radium is a splendid encouragement to persist and improve this mode of treatment. A few cases, selected from 350 treated, follow.



## ROENTGENOLOGY OF THE MALE URETHRA NOTES ON THE ANATOMY PHYSIOLOGY AND PATHOLOGY

BY AERL C. BURDEN, M.D. ROCKFORD, MINNESOTA  
Fellow in Surgery The Mc Foundation

THE most important recent advance in urologic diagnosis was the introduction of the roentgen ray examination of the upper urinary tract after the renal pelvis and ureter had been filled with an opaque solution. In 1910 Cunningham applied a similar method to the male urethra, and was able to demonstrate the outline of strictures in the roentgenogram. Urav in 1912 and Pfister in 1920 also used this method for the diagnosis of urethral stricture and fistula. Their technique was, briefly, as follows:

The urethra was filled with an opaque medium suspensions of barium sulphate or bismuth subnitrate the external orifice closed by compression and the roentgenogram made by a dorsoventral exposure. They were unable to show the posterior urethra and the bulbous portion of the anterior urethra was poorly defined because of overlapping of shadow. Handek in 1921

worked out a definite technique for showing in profile the outline of the entire urethra. He placed the patient in the dorsal position, and then tilted the pelvis to an angle of 45 degrees with the horizontal. The sensitized plate was placed beneath the pelvis (Fig. 1) with the Coolidge tube centered over the symphysis and perpendicular to the plate and the exposure was made during the injection of the urethra with a 20 per cent solution of potassium iodide. In this manner the anterior urethra bulb and posterior urethra were clearly shown. Two French observers Becker and Henry have recently used the method in the study of strictures.

In the beginning of the present investigations certain cases of strictures were studied by Handek's method but later his technique was modified so that by first filling the bladder with an opaque solution and then making the roentgenogram the outline of the entire lower urinary tract was revealed. Observations were made on a series of lesions of the urethra and bladder outlet as well as on a series of normal cases. The present technique of myophysis. The pelvis must be inclined to an angle of 45 degrees with the horizontal in order to show the outline of the urethra in profile and the opaque solution must be flowing through the urethra into the bladder during the entire time of exposure. If the urethra and bladder are merely filled and

the external orifice is sealed before making the exposure there will be no shadow cast by the posterior urethra because it is empty (Fig. 2). A number of opaque solutions and suspensions may be used but a 5 per cent emulsion of silver iodide has been found the most satisfactory.

This method of diagnosis is not without danger. It should not be used immediately after cystoscopy. Too much force should not be used in injecting the solution because of the danger of extra sensation from a diseased urethra. It also has limitations as a diagnostic procedure and in no instance will it displace direct inspection through the urethroscope when the latter can be used. By applying the method to a number of normal cases, interesting observations were made on the anatomy and physiology of the male urethra. It was noted that the injection fluid always meets resistance at the distal entrance to the posterior urethra and as a result the bulbous portion dilates markedly (Fig. 3). Then as a result of injection force and muscular relaxation, the fluid enters the posterior urethra and passes into the bladder. The posterior urethra always can be definitely located between the bulbous expansion and the outline of the base of the bladder and appears in the roentgenogram as a very narrow shadow connecting these two parts. The narrow shadow characteristic of the posterior urethra. I have not been able to distend it beyond this point. As I have stated, the posterior urethra is empty and will not cast a shadow if the opaque solution is not flowing through it during the entire time of exposure. This will occur in spite of the fact that the bladder is distended at one end and the bulbous portion of the anterior urethra at the other. Regardless of the degree of distension of the bladder the narrow streak of opaque solution from the posterior urethra joins the base of the bladder at a right angle. These observations seem to indicate that (1) the posterior urethra is normally in a state of constant tonic contracture and closure (2) it maintains this condition of closure in the presence of a distending force on either side (3) the posterior urethra never becomes a part of the bladder creating the so called vesical neck even when the bladder is fully distended and (4) the entire length of the posterior urethra

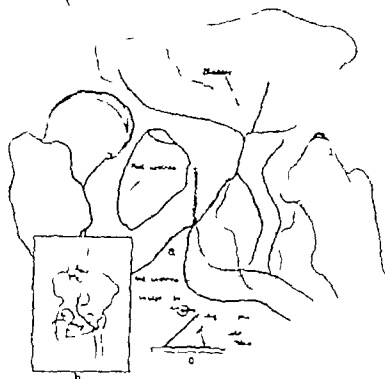


Fig. 1. Outline of urethra and base of bladder showing relation of bones of pelvis. 2. Insertion of penis in making urethrograms. 3. Urethra made by penis with plate and position of Corleone tube.

takes part in maintaining the closure of the bladder there being no evidence of an internal and an external (caval) sphincter with separate and independent functions.

According to Pieroni, the musculature of the urethra is composed of an inner longitudinal and an outer circular layer. If the action of the internal vesical orifice is observed through a supra-pubic opening during the act of micturition what appears to be a pulling down of the trigonal region into the posterior urethra will be seen. Leatham Green has shown that the caval sphincter serves to maintain perfect closure of the bladder without the appearance of a funnel even in the presence of enormous intra-caval tension. In the performance of cystoscopy in patient having cord lesions, such as tabes dorsalis, varying degrees of relaxation of the internal sphincter may often be noted but a Caulk and his coworkers have shown in their study of the nervous diseases of the bladder the relaxation of the sphincter must be extreme before funneling appears in the cystogram (Fig. 4). Results ob-

tained by a combined study of the urethra and bladder are in accord with the foregoing observations. The musculature of the posterior urethra is intimately connected with that of the prostate both anatomically and physiologically. It has been averted that, in cases of enlargement of the prostate, the gland by pushing into the bladder displaces the internal sphincter toward the periphery with resulting loss of its function. I have been unable to find proof of this. Urethrograms made in cases of enlarged prostate have shown normal vesical closure (Fig. 5). I believe that the collar of muscular tissue in the brim of the bladder following prostatectomy is the musculature of the wall of the bladder and not the displaced internal sphincter.

What, then, are the changes in the caval outlet that follow the removal of the enlarged prostate by the supra-pubic route. Wallace and Page in 1911 were perhaps the first to report the appearance of the cystogram following prostatectomy. They noted the presence of a prostatic pouch, but they also observed that in certain



Fig. 2

Fig. 2. Combined urethrogram and cystogram. Not normal dilatation of bulbous portion of urethra. Posterior urethra not shown because injection was not made during time of exposure.



Fig. 3

Fig. 3. Normal urethrogram showing anterior rethra peno-scrotal angle bulks narrow shadow of posterior urethra, and bladder. Not absence of esecal neck or funnel.



Fig. 4

Fig. 4. Cord bladder showing funneling at base of bladder and shortened posterior urethra.



Fig. 5

Fig. 5. Combined urethrogram and cystogram in case of prostatic hypertrophy showing normal anterior and posterior urethra with elevation of base of bladder. Not perfect bladder closure.



Fig. 6

Fig. 6. Roentgenogram taken 6 months after suprapubic prostatectomy and showing funnel and outlet of the bladder.

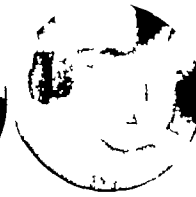


Fig. 7

Fig. 7. Four weeks after suprapubic prostatectomy. Not perfect esecal closure and absence of funnel or pouch. Posterior urethra shorter than normal.

cases the cystogram showed a straight base line. They concluded that a man can micturate normally without an efficient internal sphincter. Human made cystograms in 38 patients after prostatectomy. In 28 there were two cavities, one the bladder the other the pouch formerly occupied by the prostate. In the remaining 10 only a slight funneling occurred and in a few no changes from the normal were noted. In the study of cases after prostatectomy I have noted the funnel (Fig. 6) in certain instances, and also rather often, the absence of either funnel or pouch (Fig. 7). Urethrograms were made in these cases, and they showed the characteristic narrow shadow of the posterior urethra leading up to the base of the bladder or to the apex of the funnel. The shadow

was shorter than normal because of the absence of a portion of the prostate and urethra. I wish to make it clear that even after removal of the prostate a considerable portion of the posterior urethra remains. It has been observed at necropsy in cases in which the prostate had been removed 6 months or a year previously that the base of the bladder is sometimes smooth, there being no evidence of a pouch or funnel. Tandler and Zuckerkandl have shown that in suprapubic prostatectomy only the portion of the gland above the level of the colliculus is removed and that a portion of prostatic urethra surrounded by prostatic tissue remains. My study seems to show that the remaining portion of prostatic urethra with its musculature as well as the compressor



Fig. 8

Fig. 8. Urethrogram of stricture showing contracture of entire anterior urethra.



Fig. 9

Fig. 9. Multiple strictures of urethra, suburethral tract and multiple penile fistulae.



Fig. 10

Fig. 10. Diverticulum of the posterior urethra connected with contracted bladder. The entire prostate had been destroyed by tuberculosis.

urethral muscle, play an important part in vesical control after prostatectomy. The presence or absence of a pouch after enucleation is of little practical importance so far as function is concerned.

Urethrograms made in cases of stricture have shown the interesting fact that the entire anterior urethra is often involved in a cicatricial process which converts it into a narrow inelastic tube. The characteristic distensibility of the bulbous portion is lost (Fig. 8). It is unable to demonstrate stricture of the posterior urethra because the normal shadow cast by this part is very narrow, but in cases of stricture with incontinence of urine, the opaque solution could be seen flowing without interruption into the bladder. In two cases of stricture following fracture of the pelvis, there was present in the urethrogram peculiar break in the continuity of the urethral shadow, like the displacement of fractured part. Cases of multiple strictures of the anterior urethra, which do not permit the passage of an instrument, can be readily located and outlined in the urethrogram. In two cases of stricture of long standing the presence of a suburethral tract parallel with the main canal was noted, probably the result of tunneling by an instrument (Fig. 9). Permanent urinary fistulae usually originate in the bulbous portion of the urethra. The number and tracts, as well as their point of origin, can be demonstrated in the urethrogram.

Diverticula of the posterior urethra may be congenital or acquired. A large diverticulum of the posterior urethra, the result of tuberculous abscess of the prostate in a boy, was revealed in the urethrogram as a large cavity equal in size to and connected with the bladder (Fig. 10). Several cases of penile hypospadias were studied,

but the outline of the urethra appeared to be normal. In a true bilateral hermaphroditism the outline of a normal male urethra was shown.

Röntgenographic shadow in the region of the vesical outlet caused by prostatic calculi or stones in the posterior urethra, are occasionally difficult to localize. The accurate localization of such shadows can be made by urethrograms.

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## RADIUM IN THE TREATMENT OF VASCULAR NAevi

By FRANK EDWARD SIMPSON M.D. CHICAGO

Professor of Dermatology Chicago Policlinic, Adjunct Clinical Professor of Dermatology Northwestern University Medical School, Former Chief of Dermatological Staff Cook County Hospital

WICKHAM and Degrais (1) were the first to publish an extensive account of the results obtained with radium in the treatment of vascular naevi. In American literature, articles dealing with this topic have been published by Newcomet (2) Montgomery and Culver (4) New (5) the writer (3) and by a few others. With the exception of my chapter in *Oxford Surgery* (6) few if any modern works on surgery or dermatology contain more than a casual reference to this mode of treatment. The method apparently has not gained a wide degree of popularity, perhaps because of the costliness of the necessary equipment.

In the last ten years I have treated with radium more than 300 cases of vascular naevi. Not all cases have been treated with the success, from a cosmetic standpoint, that was at first thought possible. I believe, however, that this method of treatment is, in most cases, the best that is now available. In dealing with naevi that are very extensive and growing rapidly it is the only method that promises any degree of success.

## METHODS OF TREATMENT

In rare instances vascular naevi may disappear spontaneously. Sometimes ulceration may occur and involve a part or all of the naevus, the final result being its partial or complete disappearance with scar formation. In some cases, a naevus may appear a few days after birth and grow rapidly. In other cases, it may increase in size very slowly as the child grows. In most cases after a naevus appears, it remains stationary.

We believe that it is unwise to allow naevi to remain without treatment on the ground that they may disappear spontaneously. Naevi that are growing or become ulcerated should have immediate treatment. Naevi that merely cause disfigurement may be treated in more leisurely fashion but they are more amenable to the treatment when it is begun in earliest infancy.

The object of the treatment of vascular naevi when it is undertaken for cosmetic purposes is, of course, the decolorization and in some cases the leveling of the tumor so as to render it less unsightly. Uniformity of coloring and smoothness of the surface of the treated areas must be attained if possible. Dangerous and very painful methods

of treatment should we think, be abandoned. Methods that are liable to result in unsightly or uneven coloring or that are productive of keloidal or excessive scar tissue should also be given up.

Various physical, chemical, electrical and acoustic methods have been used. The principal methods other than the use of radium are:

1. Surgical procedures, such as excision, ligature, scarification, etc.

2. Intense heat or cold (actual cautery or freezing).

3. The injection of various substances, such as boiling water, hydrogen peroxide, tincture of iodine, etc.

4. Chemical caustics, as nitric, sulphuric or glacial acetic acid, etc.

5. Electrical methods, as electrolysis, electrocoagulation or the high frequency current.

6. Actinic therapy, such as X-rays, or the Kromayer lamp.

Surgical or operative procedures are suitable, as a rule, for small naevi only. Pedunculated naevi may be treated by excision. In certain types, such as the cavernous naevi, there is some danger of venous or even fatal hemorrhage as a result of excision, and recurrences are not unusual. The cosmetic results of surgical procedures are usually inferior to those obtained by other means.

The cautery is seldom used at the present time and we think it should be abandoned altogether.

Freezing with liquid air is its more convenient substitute, carbon dioxide snow has had some degree of popularity. This method has the advantage of being rapid and economical. It appears to be of most value in superficial cavernous naevi of small extent. It may be used in certain cases as an adjunct to radium treatment, as in the clearing up of very small foci. The freezing method is painful, however, and hence cannot be repeated indefinitely in the same patient and especially in dealing with children. It should not be used in flat naevi of the port wine stain type. In extensive cases it is next impossible to obtain a good cosmetic result as the coloring of the skin may be uneven. In some cases keloid may develop from its use. After a considerable experience with the freezing method we have abandoned it altogether except in rare cases and usually as an adjunct to other measures.





Fig. Purplish red, vascular nevus of raised, hard type, involving left side of cheek and upper lip in girl aged 9 years. Photograph taken September, 1913. The presence of considerable connective tissue in the angiomata renders the treatment of this type of nevus quite difficult.

The injection of various substances into vascular nevus is not to be recommended. The method is painful and not without danger.

The use of chemical caustics has practically been given up. Caustics are painful and their use may be followed by keloidal or scar tissue. Glacial acetic acid is sometimes of value in the treatment of very minute areas.

Electrolysis is of value in the treatment of "spider naevi" and small telangiectatic areas. Injudicious electrolysis may be followed by scars or keloids. Electrocoagulation and the high frequency current may be useful in rare cases. The electrical methods are all painful and are not adapted to large tumors.

X rays have been used in vascular naevi and in rare cases with very good results. It would appear, however, that to be successful the dosage must be pushed to the point of producing a mild dermatitis. X rays have apparently no constant or marked effect on large angiomatous tumors.

The  $\gamma$ -rays from radium, however, have a very pronounced effect on all types of angiomata. We cannot agree therefore, with those authors who hold that  $\gamma$ -rays and X-rays are practically identical in their action. The Kromayer lamp was employed at one time with some prospect of suc-



Fig. Patient in figure 9 years after removal of nevus with radium. For several years following treatment patient is subject to slight attacks of dermatitis involving treated area. Surface of nevus is smooth and discolored. Photograph, taken May, 1922, not retouched.

cess in selected cases of superficial flat naevi (port wine stains). In some cases this method has been used in conjunction with radium, toles as suggested by Wickham and Degraze. We have now, however, abandoned the Kromayer lamp altogether in the treatment of naevi.

#### ADVANTAGES OF RADIUM TREATMENT

Radium is unique in the fact that it exerts a marked action on the blood vessels of the nevus, other tissues being only slightly or not at all injured.

The painlessness of radium is one of its points of superiority over other methods. This factor is of importance especially in the treatment of children.

If the method of application is correct, there is very little scar tissue following the use of radium. Contractures seem never to occur—a feature of great importance when angiomata are situated about the eyelids, nose, or mouth.

The cosmetic results are usually superior to those obtained by other methods. As in all cosmetic disorders, the results of treatment naturally depend very largely upon the care and fidelity to detail with which the treatment is carried out.

In rapidly spreading naevi and in cases occurring in infants in which the lips are involved and



Fig 3. Purplish red vascular nevus of raised soft type involving left side of face including mucous membrane of lips in baby aged 6 weeks. Photograph taken September, 1935. Patient referred by Dr. David Lee Bethel.

sucking is seriously hindered, life may be saved by prompt radium treatment.

#### DISADVANTAGES OF RADIUM TREATMENT

In some cases radium treatment is slow and tedious and the economic features must be considered. In children, however, the time factor is usually of little importance provided the final cosmetic result is good. In the course of a few days or at the most in two weeks, sufficient treatment can be carried out to produce a marked effect on the nevus even in the most extensive cases.

In some cases in which a sharp inflammatory effect may have been produced by the treatment and the skin later on may have become atrophic attacks of dermatitis affecting the involved areas may occur at intervals for a number of years. These attacks are known as delayed or deferred reactions. They may closely resemble the primary reaction. Sooner or later these attacks cease altogether.

In other cases, as the final result of treatment the nevus may appear too white or the skin may become somewhat atrophic and telangiectasia may develop.

In still other cases, the site of the nevus may be slightly depressed. Sometimes a slightly increased tendency to freckling of the skin over the nevus may be noted.

We have never seen, however, any other untoward effects and in many cases these undesirable results that have been mentioned may be avoided



Fig 4. Patient in figure 3, 9 years after removal of nevus with radium. Area of nevus is smooth and decolorized. Photograph taken June 9, 1944, not retouched. Presence of freckles detracts from appearance of photograph.

altogether by a sufficient amount of care in carrying out the treatment.

#### THE TECHNIQUE OF RADIUM TREATMENT

A description of the technique of the application of radium and illustrations of a number of cases may be found in the author's book on *Radium Therapy* (7) so that many details of the method may now be omitted.

At the present time in the treatment of angiomata we usually employ surface radiations, that is, radiations that are used directly over the surface of the nevus, the radium being applied closely to the skin or at a distance of a few millimeters or centimeters. In rare cases, emanation tubes may be introduced into the substance of the angoma. When the nevus is situated on the face and the cosmetic result of the treatment is very important, surface radiations are always used as the effect is more easily controlled. After a series of exposures has been given it may be advisable in some cases to repeat the course of treatment in about 8 weeks. In other cases, a longer time may elapse between courses of treatment as subtle modifications in the appearance of a nevus that has been subjected to radium exposure may go on for many months.

In the case of very extensive ulcers, if some time difficult to avoid the production of a checkered effect. In these cases, we have resorted to the very simple procedure of outlining with ink, at the conclusion of an exposure the area treated. This outline remains until the next exposure. We thus obtain an exact approximation of the area of each area that is treated.

Overdosage must be carefully avoided and indeed it may be stated as an axiom that no one should never be subjected to doses that cause dermatitis until selectively non-inflammatory doses have been found ineffective. We have frequently seen vascular ulcers become untractable by judicious or excessive treatment.

We would lay special emphasis on the necessity of an adequate radium arrangement which must be adapted to the requirements of each individual case.

From the standpoint of treatment Wackham and Duguid divided angiomata into five clinical groups. These are:

1. The superficial vascular nevi located within the skin. Certain types are known as "port wine stains." These usually disappear on pressure.

2. The deeply infiltrating vascular nevi, level with the skin. These usually can not be made to disappear on pressure.

3. Red hard vascular nodules. These may become very sclerotic surface. Some are pedunculated.

4. Hard, soft vascular nevi. These tumors are sometimes pulsatile and erectile. The so-called "cavernous angioma" is a frequent type.

5. Deep, lobulated, neurovascular neurofibrous tumors.

The different groups mentioned may merge into each other and exist together in the same individual or in the same tumor.

1. *That superficial vascular nevi.* In the treatment of this group we would emphasize the great importance of a careful inflammatory reaction.

In some cases one may produce a mild erythema of the skin. In others one produces a should never be repeated. Secondary inflammatory reaction may be followed. In the appearance of untractable angiomata although this may not be desired for several years.

In our experience no type of apparatus is so successful in this group as the flexible radium tube. Theoretically perfect uniform application of radium on the skin is not produced by using a number of tubes connecting the method described in the author's book on *Radium Therapy*. The practical difficulties however of using radium in the type of a vascular almost insurmountable

able and in our opinion they should never be employed. No class of cases requires a more refined or skillful technique but in some cases a very satisfactory result may be obtained.

In other cases only partial fading of the nevus can be brought about. If a frost rose color is firmly of tained treatment should be discontinued altogether for at least several years.

1. *That deeply infiltrating nevi.* It is impossible to expect nevi of this group when situated on the face by any of the artifices of the toilet such as rouge or powder. Radium treatment is therefore justified even though the result may not always be a perfect one could be desired. Even in the more unfavorable types a result can often be obtained that permits of concealment by various devices. In some cases doses strong enough to produce a dermatitis must be used with the result that the lines of the face may become trophic and telangiectatic may develop. In some cases, however, a very good effect may be obtained. In the treatment of this group we always employ the "toilet" or glazed plaques for producing inflammatory reaction.

3. *That hard red nodules.* In this group, also, a mild inflammatory reaction must often be produced by the radium in order to level and devitalize the tumor. The presence of considerable vascularity in the angioma renders the treatment of this type of nevus quite difficult. In some cases, the tumor has a fairly smooth and somewhat thin appearance but is not however unsatisfactory when compared with the original appearance of the growth itself. In some cases also telangiectatic may develop. Usually the artifices of the toilet enable patient if necessary to conceal the treated area quite well.

In this group of cases also we may use the "toilet" or flat glazed plaques for producing inflammatory reaction.

4. *That red soft nodules.* In this group the results of radium treatment are most satisfactory. Large angiomas which may cover one half of the entire body may sometimes be made to disappear without inflammatory reaction. In the treatment of this group inflammatory reaction must be avoided if possible. It should be produced the *acute effect* in selected cases may be very evident. In some cases the treated area may have almost the appearance of the normal skin. In this type of angioma we employ rather the "toilet" or glazed plaques or in some cases the "toilet" or glazed plaques.

1. *That of neurovascular.* Other method of treatment can be compared with the use of radium in this type of nevus.

5. *Deep subcutaneous and submuscular vascular naevi*. In these cases it is important to place the radium at a considerable distance from the skin and to use relatively large doses. At the present time we use larger doses in the treatment of this type of angioma than we formerly employed. In this type of tumor we nearly always employ emanation tubes. In carefully selected, adult cases, 500 millicuries of radium emanation may be placed at a distance of 6 centimeters from the skin. A total exposure of 20 hours divided into two or more periods may be given. In cases occurring in infants, 250 millicuries may be used at a distance of 3 centimeters from the skin for 10 hours. The exposure may be divided into two or more periods. With the above technique no visible inflammatory reaction in the skin will result, but a marked effect may be noted on a deeply situated angiomatous tumor. In our judgment no other method of treatment is so successful as the proper use of radium in this type of naevus.

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## A HEAD CLAMP STETHOSCOPE HOLDER

FOR THE RAPID AND SECURE ADAPTATION OF THE STANDARD BELL STETHOSCOPE TO THE HEAD

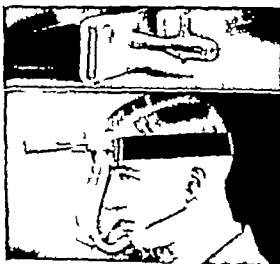
H. I. M. HARTLETT, CHURCH  
 St. Joseph's Hospital, Medical School

In an endeavor to make the standard bell type of stethoscope serve the added rôle of head-stethoscope in a simple, inexpensive yet efficient manner a head band and special clamp has been devised. It is adjustable to any of the standard Ford and Shephard types of instrument. A Bowles' lens adapted.

There is nothing new about the head band or frontal plate. The special clamp, rigidly fitted to the frontal plate and carrying two molded jaws which grip the stethoscope bell at the bifurcation of its stem. A strong thumb-screw secures these parts in position. No change whatever is necessary in the stethoscope.

The device designed primarily to make the standard stethoscope serve the dual purpose described by some medical talent.

The operator is permitted to employ his old instrument which none fits his ear. The long tubes are no appreciable obstruction to his field of vision and the operator can wear glasses. His



hands are free, the bell can be tensely applied, and no loss of sound is gained.

# SUPRAPUBIC CYSTOTOMY AS A DIAGNOSTIC AND THERAPEUTIC MEASURE IN CERTAIN CASES OF RENAL TUBERCULOSIS<sup>1</sup>

N. F. RATHBUN, M.D., F.A.C.S. BROOKS

From the Urological Service of Brooklyn Hospital

**B**ELIEVED it is rather generally accepted that tuberculosis of the urinary tract is primary in one kidney. This statement does not include tuberculosis of the seminal tract which should be considered separately, and it is made with the understanding that in a large percentage of cases, healed or quiescent or perhaps active tuberculous lesions may be demonstrated in remote parts of the body. I believe too, that it is generally accepted that the treatment of renal tuberculosis is surgical, provided that there are no active remote lesions, that the patient's general condition warrants a major operation, and that we can demonstrate that the other kidney is competent to carry the entire burden of renal function.

In the great majority of cases all these items can be accurately checked up by the ordinary means at our disposal: cystoscopy, ureteral catheterization, radiography and the usual laboratory procedures. However, it is a fact that many if not most, of the cases which come under our care have extensive lesions of the bladder: ulceration, contraction, limited bladder capacity, etc. Thus, of course, adds materially to the difficulty of cystoscopy, and many patients require repeated examinations, usually with some form of local or general anesthesia. Occasionally a patient presents himself in whom it is absolutely impossible because of limited capacity and inability to wash the field free of blood, pus, and tenacious mucus, to catheterize the ureters or even get a satisfactory view of the bladder. Thus, at least, has been my experience, and there have been three such cases out of a total of fifty-five cases of tuberculous kidneys observed at my clinic at the Brooklyn Hospital during the past 5 years. One of these, the first of the three, following his fourth cystoscopy done in a many weeks under prolonged general anesthesia and with repeated irrigations, developed symptoms of urinary extravasation, and in spite of extensive and what appeared to be adequate drainage, died. The autopsy revealed the body of a young, well-developed adult; there was a small rent in the left posterolateral wall of the bladder at the bottom of a tuberculous ulceration; there was extensive extravasation of urine deep in the pelvis and extending up along the course of the ureter. The

traces were necrotic; the kidney on that side showed well advanced tuberculous lesions; the opposite kidney was perfectly sound, and careful search failed to reveal any other focus of tuberculous in the body. This incident was tragic and deplorable, but it demonstrated rather emphatically to my mind that there is a mortality, small of course but nevertheless a mortality, attached to cystoscopy on tuberculous bladders. At any rate, cystoscopy in such cases may assume the proportion of a major operation. Anesthesia of some form is usually essential, and that item alone is not without risk. Any form of inhalation anesthesia, particularly if prolonged or repeated many times, is of course objectionable, spinal and sacral anesthesia are not dependable, and local anesthesia doesn't work. Given then such a case in which after a reasonable trial two or more competent cystoscopists have been unable to perform a satisfactory cystoscopy, what shall we do in order to effect a complete urological diagnosis? It is true that a good roentgenograph will often give us a lead. Hirsch has pointed out certain rather characteristic findings. However, they are by no means constant, and the X-ray certainly gives us practically no information about the other kidney. Subjective symptoms are often misleading. In one of the two cases reported below these signs pointed to the affected organ, while in the other case they pointed rather definitely to the healthy side. Before the development of the modern cystoscope and I believe occasionally since that time several methods have been suggested for the purpose of solving the problem: the segmental laparotomy with exploration of both kidneys followed by immediate nephrectomy on the evidence thus obtained; lumbar incision on one or both sides with or without aspiration of urine from the renal pelvis; exposure of one ureter in the groin, applying a temporary ligature while urine from the other side is collected from the bladder, etc. In my opinion these procedures have but little to recommend them and much to be said against them.

In two cases reported below I performed a suprapubic cystotomy, passed catheters through the urethra, and guided them into the ureters through the open bladder, and in this way ob-

tained all the information required. When the problem first presented itself to me I could find no reference to such a procedure in a casual survey of readily available literature, and felt that I was treading upon new and uncertain ground. In preparing this paper I had made for me by the Literary Research Bureau of the American College of Surgeons a careful review of the literature and found as usual that there is nothing new under the sun. However the references were few in number and a careful search covering the literature for the past 15 years developed only four articles published during that period. These were all by French writers.

Marion (1) in a clinical lecture published in 1912 recommends it. He credits Albarran as being the first operator to employ it. He notes the fact that it may be difficult of performance and also emphasizes the point that in addition to its diagnostic value it has the added advantage of putting the bladder at rest. At the conclusion of his address he catheterized through her bladder the ureters of a young woman. When he opened the bladder he found ulceration of the entire trigone and neck. In spite of this, catheterization was relatively easy. Contrary to his previous opinion it was the left and not the right kidney which was diseased. The ulcerations were treated with the thermocautery and the bladder drained. Left nephrectomy was planned for a later date.

Carlier (2) writing in 1912 considers this procedure of value in cases where it is impossible to catheterize the ureters in the ordinary way and has employed it in certain cases. He cites two objections to it that it may be extremely difficult and that the suprapubic fistula may be slow in healing. He reports two cases requiring 2 and 4 months respectively. He prefers lumbar incisions, beginning with the supposedly healthy kidney and immediate nephrectomy on the evidence thus obtained. Personally I doubt very much if the information obtained in this way is, in any sense, conclusive or reliable.

Pasquereau (3) writing in 1912 reports one case in which he feels that nephrectomy alone would not have been enough to have relieved the symptoms. He catheterized the ureters through the open bladder which he found very extensively diseased. There was immediate relief of symptoms and nephrectomy was performed later. Following this he expected the suprapubic fistula to heal. It did not heal, and the patient was finally discharged with a permanent suprapubic drain. Both the operator and the patient seemed quite satisfied with this arrangement.

Cathelin (4) writing in 1918 states that in 50 per cent of the cases of renal tuberculosis it is impossible to catheterize the ureters in the ordinary way. He mentions catheterization through the open bladder only to condemn it citing as his objection the technical difficulties and the danger of a permanent fistula. He recommends as an alternative one of three measures: (1) the segregators, (2) lumbar incision with aspiration of urine from the kidney pelvis, (3) temporary ligation of the ureter on the supposedly diseased side through a groin incision, and collection of urine through the bladder from the supposedly healthy side. With all due respect to Cathelin, I am by no means convinced of the wisdom of his choice of procedures. I believe that suprapubic cystotomy with catheterization of the ureters through the open bladder is entitled to a place as a diagnostic measure in certain cases of renal tuberculosis. I should entertain this opinion if it served no other purpose than that of a diagnostic procedure. There are, however, two other functions which appear to me to add materially to its value. First, it puts the bladder and the patient himself at rest and enables us to get him in better shape for nephrectomy later. A patient who is urinating every 30 minutes night and day with each act of urination accompanied by pain, is not an ideal candidate for a major operation. Second, it gives us an opportunity to treat the bladder lesions locally and perhaps in this way amehorize and shorten the extremely protracted bladder convalescence so often noted after nephrectomy for renal tuberculosis. In my cases I swabbed the diseased areas with pure carbolic acid followed by alcohol. Other perhaps better methods might readily be suggested. These latter items lead me to feel that with a little more experience one might broaden the indications for this procedure to include not only those cases in which satisfactory cystoscopy is impossible but also those cases in which there is an extreme degree of vesical distress and in which cystoscopy while possible would be extremely difficult.

Four criticisms very naturally suggest themselves:

1. It is a confession of weakness and perhaps lack of cystoscopic skill. That may be true and yet I believe that some of these cases will baffle the most skillful among us.

2. It is an added operation with added attendant risk. In my opinion cystoscopy may be and often is attended by quite as much shock and discomfort as is cystotomy and is not entirely devoid of risk and furthermore it does not always accomplish its aim.

3. The operation may be difficult or impossible to perform. I doubt if it should ever be impossible. The fact that it may sometimes be difficult is hardly a valid objection provided the procedure is handled. A minor point of technique which I have found of value is to have an assistant pass an endoscope with a light in the distal end through the urethra. I believe that this provides better illumination than can be obtained by reflected light or light carrying retractors, and adequate illumination is an important factor in the operation.

4. That the pyrapubic fistula will not heal. A consideration of this possibility is, of course, of extreme importance. And the merit of the procedure might well be decided upon this point. In one of my patients the wound healed promptly and kindly. In the other patient the healing was protracted because of certain complications, but was eventually complete. It is my belief that while the closure might be delayed in some cases, all or certainly most of them will eventually heal. I believe that in those cases in which healing is delayed or in which a fistula might persist the bladders would be so badly diseased that the symptoms persisting after nephrectomy would be almost if not quite as distressing as a suprapubic fistula.

There follows a very brief résumé of my two cases.

CASE 1. A male, aged 30, admitted to the hospital December 20, 1917. Patient had been in good health until February 9, 1917, at which time he passed blood in his urine. Soon thereafter he had backache, more particularly in the right loins. He has had dry, and frequent, urinating gradually, once until now he is urinating every 1/2 hour, day and night. He has lost 20 pounds in weight during the past year. Exams. (1918). The chest appears clear. The right kidney is palpable at tend. The left kidney cannot be felt. The urine contains pus, blood and tubercle bacilli. During absence from hospital he was cystoscoped on four different occasions. He is given oxygen anesthesia. At no time, as far as possible, catheterize either writer or I obtain satisfactory view of the bladder. On January 9, 1918, suprapubic cystostomy, as done under gas oxygen. The bladder, prostate and bladder base are covered with tuberculous ulcerations. These are about the pure carboic acid followed by alcohol. The ureteral orifices are readily located on either side. The right kidney pelvis is on the right side. On the left side obstruction, as encountered in the intraluminal portion of the ureter, but is passed in little manipulation.

The suprapubic incision is partially closed in the usual manner with rubber drainage tube in the bladder. (Clear and normal phlogistons are obtained from the right side, from the left side the same, loaded with pus and tubercle bacilli and no phlogistons were secreted in hour. The relief from symptoms is immediate and striking. The patient lived several nights and gained rapidly in weight and general strength.

On February 4 (1 week after cystostomy) left nephrectomy was done. The kidney showed no cancer and extensive tuberculous. Operative course otherwise was unremarkable.

On February 18 (8 days after nephrectomy) day after cystostomy) he was washing most of his urine through the natural channel. February 26 (4 days later) the suprapubic wound is closed. On February 25 he was discharged, his small wound in the kidney wound.

April. Kidney wound is broken do throughout, nearly at hole. Patient is urinating every 1 hour by day and at night.

July. The kidney wound is closed. He is urinating every 3 hours by day and once at night. There is still pain in the ureter.

February 20, 1919. Admitted to medical ward with story of headache, chills and fever for week. He reports that he has been very comfortable so far as his bladder is concerned except that he has been obliged to urinate once at night. There is suggestion of rapidity in his back aches. The cerebrospinal fluid shows marked increase in cell count and tubercle bacilli. Death occurred on March 6, 1919 from tuberculous meningitis.

While the end result in this case was unfortunate, I feel it was no reflection on the procedures employed. The relief from symptoms in the interval between his cystostomy and his nephrectomy was most striking and the rapidly progressive improvement in bladder function following his discharge from the hospital was very different from the tardy progress so often noted in these cases.

CASE 2. Male, 35, admitted to the hospital September 2, 1917. Past and previous history irrelevant. For the past 3 years he has felt below per urethra and urinated at night. For the past month dysuria and frequency rapidly progressive. (October 1917) 7 weeks ago (terminal) hematuria. He now urinates every 20 to 30 minutes day and night. He has been cystoscoped twice in the out patient department with negative findings.

Examination. There is dullness and bronchovascular breathing over the right apex extending to the third rib. There are no cough, no rales, no sputum. The chest lesions are kindly healed. Neither kidney is palpable but there is some tenderness in the left costovertebral angle. The W. sedimentation reaction is negative. Phlogistons, 40 per cent. Blood chemistry: urea, 30; creatinine, 5; sugar, 14. Carbon dioxide combining power, 7.9. Roentgenogram shows the right kidney enlarged. The left kidney is not clearly seen. At the right side just below the sacral promontory apparently in the course of the ureter there is a large indistinct shadow about centimeter in its longest diameter. This suggests ureteral calculus.

September 1, 1918. Cystostomy with gas-oxygen anesthesia. This is very unsatisfactory neither writer or Dr. C. could be seen nor could one get very satisfactory view of the bladder, all except to get the general impression that it is almost kinked.

September 20, 1918. Cystostomy under gas-oxygen anesthesia. There is extensive ulceration involving about the entire bladder mucosa. This is closed with carboic acid and followed by alcohol. The ureteral orifices are identified with some difficulty. A No. 5 catheter passed readily to the kidney pelvis on the right. Catheter did not pass on the left and fine probe as passed catches into the left ureter. Here it is definitely arrested.

A faint trickle of very cloudy urine is seen emerging around the probe. Wound partially closed with rubber tube in the bladder. Urine from right side contains a few pus cells, no tubercle bacilli. Intravesicular pythaleum appears from the right side in 9 minutes. There is no pythaleum from the left side (collected from the bladder) in an hour.

The day after operation the patient developed an acute pyelitis on his right side, with chills and fever and tender ness over the right kidney. This passed, gradually diminishing, for a week. The following week he was very comfortable and occasionally slept all night.

October 3, 1922 ( 1 weeks after cystotomy) Left nephrectomy. This was particularly difficult. The kidney was double normal size, high up under the ribs, and very adherent. About 5 inches of much thickened ureter was removed with the kidney. It had been our intention to remove the entire ureter but at this stage of the operation the patient was showing considerable shock and the ureterectomy was abandoned. Convalescence was rather stormy. Both wounds became badly infected.

December 4, 1922 There was severe chill, and temperature of 104, scanty urine, and much pain and tenderness over the right kidney.

December 6, 1922 Total anuria.

December 7, 1922 Cystoscopy with gas-oxygen anesthesia. It is of interest to note that on this occasion, in spite of his stormy time the bladder was sufficiently improved so that it was a relatively easy matter to identify and catheterize the right ureter. The catheter was passed to point just proximal to the ureteral promontory where it met definite obstruction. This was finally passed and there followed gush of cloudy urine through and around the catheter. There then occurred fairly prompt subsidence of symptoms, the temperature reaching normal 5 days later where it remained. On December 9 a calculus was passed as noted in the roentgenogram.

Convalescence after this was uneventful. Discharged on January 9, 1923. Kidney sound granulating. He is voiding all urine by day but there is little leak from the suprapubic fistula by night. This was entirely closed 3 weeks later. The closure had required fourteen weeks.

April 2, 1923 Both wounds healed. His gait is good. He is working. Urinates every hour by day twice at night.

Obviously this patient had a very stormy time but I believe in spite of and not because of the methods followed. His complicating right ureter calculus and pyelitis were, of course, important factors in retarding his recovery. Notwithstanding all this I believe that he is further along with his bladder convalescence than he might have been had he been handled in a more orthodox manner.

#### CONCLUSIONS

In conclusion I submit for your consideration:

1. That in cases of renal tuberculosis where it is difficult or impossible to catheterize the ureters in the usual manner suprapubic cystotomy is the method of choice for the purpose of making a complete diagnosis.

2. That because of certain therapeutic advantages made available by the procedure, increased experience may broaden the indications.

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## EDITORIALS

### SURGERY GYNECOLOGY AND OBSTETRICS

FRANKLIN H. MARTIN, M.D.  
ALLEN B. K. VETZ, J.D.

Managing Editor  
Associate Editor

WILLIAM J. MAYO, M.D.

Chief of Editorial Staff

MARCH 1921

#### BRODERS INDEX OF MALIGNANCY

**F**OLLOWING the removal of a malignant growth the important question with regard to the permanency of cure arises in the mind of both surgeon and patient. In 1919 Broders, of the Mayo Clinic described a method of measuring the degree of malignancy in neoplasms. He studied 2000 malignant growths grouping them in four grades according to their degree of malignancy. The basis of the index depended on the fact that the more a neoplastic cell tended to differentiate or in other words to approach in structure a normal cell the lower was the degree of malignancy and likewise the more malignant the tumor the more undifferentiated or embryonic were its cells. The four groups were graded according to the approximate proportion existing between the undifferentiated cell and the differentiated cell. In a tumor of Grade 1 malignancy about three fourths of its structure contains differentiated cells and one-fourth undifferentiated cells. In a tumor of Grade 4 malignancy all the cells are undifferentiated. Between these two extremes are tumors of

Grade 2 and Grade 3 malignancy. Grade 2 contains about one half differentiated cells and one-half undifferentiated cells. Grade 3 contains about one-fourth differentiated cells, and three fourths undifferentiated cells.

The accuracy of this index of malignancy has been demonstrated by the end results following removal of growths of the lip, skin, genito-urinary organs and cavities and in ternal organ of the head and neck. From a review of the known cases of death from epithelioma of the lip, it was found that the mortality from this cause was 100 per cent in cases in which malignancy was graded 4, 84 per cent in cases graded 3 and 55 per cent in cases graded 2 while there were no deaths in the group graded 1. In other words, by grading tumors thus Broders was able to form an accurate prognosis in cases of malignancy. Lymphatics was placed on this by Percival Cole late Hunterian professor of the Royal College of Surgeons of England, at a lecture delivered at the Cancer Hospital London in 1920. In general, however the significance of this index of malignancy required almost 2 years to disseminate through the profession and yet its value became apparent in widely separated centers at about the same time. Meloney in Pekin, Aureliano Urrutia in Mexico, and Brewer in New York in writing on epithelioma accept Broders grading of malignancy as a law of prognosis. Urrutia in his monograph on *Hybrid Epithelioma* says of Broders principle of grading malignancy. The results of well proven facts will be the law which shall in the future govern the prognosis of cancer over which we shall base our diagnosis and which will prompt

the surgeon to perform, or not to perform an operation." In the same vein Meleney says

This grading is the most significant work that has been done recently on epithelioma."

Work done by Martaloff of Johns Hopkins in 1923 substantiates Broders work, in which the principle of cell differentiation as an index of malignancy described by Broders in 1919 plays the most important part. Broders determined his grading of malignancy according to the proportion existing between the undifferentiated and the differentiated cells, and classified the neoplasms on a mathematical basis, whereas Martaloff using Broders principle of cell differentiation, classified his neoplasms according to the type of cell predominating. It is interesting to note that the classifications of epithelioma of the cervix by the two observers is so similar that one is impressed with the accuracy of the method, for in comparing the end results following hysterectomy for carcinoma of the cervix, in which the most malignant type of tumor is concerned the good results reported by Broders and Martaloff are almost identical.

WALTMAN WALTERS

## FRACTURES OF THE HIP

THE problems confronting the profession in the treatment of hip fractures are gradually being solved. The common use of the X ray has afforded more accurate knowledge of the type of the fracture, and as a result many of the so-called strains and sprains heretofore unrecognized as incomplete or impacted fractures are properly diagnosed and treated. Such unrecognized fractures have, in the past, produced a considerable percentage of the coxa vara and non-unions demanding reconstructive surgery.

In recent fractures of the hip the nearest standard of treatment is undoubtedly the

Whitman method. It allows accurate reduction and fixation, but demands a knowledge of plaster-of-Paris technique. Pulmonary congestion and pressure sores are avoided by change of position, which may be accomplished painlessly once fixation has been accomplished. The use of an anesthetic and of an orthopedic table is found a valuable aid in the reduction and application of the cast. It is advisable to carry the cast from thorax to toes on the affected side molding it to the pelvis and leaving a large window over the abdomen and knee. When the cast includes only the pelvis, a double spica is advisable, carrying it down to the knee on the well side, and reinforcing it by a board just above the knees, over which plaster bandages are applied. Extreme abduction in extension with internal rotation gives practically an anatomical reduction in fractures of the hip or epiphyseal separation. In extreme old age and in cases in which anesthesia is contra-indicated the treatment may be applied with very little pain if an orthopedic table is used; it is, however, sometimes best to accept the possible deformity rather than lose the patient by insisting on treatment. The surgeon should protect himself by further consultation and by prognosticating a possible coxa vara or non union. The patient, once the cast has been applied, may be placed face down ward on the back, or turned on the side. To facilitate the use of the bed pan a Bradford frame may be placed under the patient, and by means of ropes and pulleys attached to a Balkan frame and windlass, the body may be raised and lowered without discomfort. The areas over the sacrum and patella should be massaged frequently and any pressure further avoided by change of position. Stiffness of the knee following fixation for several months, may be avoided if hinges are inserted on either side of the knee, and enough plaster

cut away behind to allow mobility. The duration of fixation in plaster should be left to the surgeon's judgment although 6 months might be suggested as a minimum. A short splint cast, crutches, or a walking caliper during the early ambulatory period should insure against possible *coxa vara* or non union. The value of repeated X-ray examination before and after reduction and during the ambulatory period should not be overlooked.

*Coxa vara* and non union are often the result of too early weight bearing. Conservative treatment since *coxa vara* has occurred is of little value. Open operation, osteotomy and prolonged postoperative fixation or traction in abduction is not always advisable inasmuch as many of these patients are aged and weakened by previous confinement. It is often advisable to accept the deformity and when recognized early attempt to prevent its increase by means of a walking caliper or crutches and elevation of the shoe on the sound leg.

In cases of non union in a good surgical risk, the unabsorbed femoral neck may be satisfactorily treated by bone grafts. The graft should be strong and may be taken from the fibula or tibial ridge. After flexing the fractured end, the graft is driven through a drill hole which passes through the trochanter neck and well into the head with the leg in abduction, extension and internal rotation. Thus the ununited fracture is held in the cast

just as is a recent fracture treated by the Whitman method, the graft acting as a mechanical peg and fixation. It affords a means of blood supply to the head and is a living bone bridge stimulating bone growth. Further support consists of an osteoperiosteal graft passing around the ununited neck. The duration of fixation must be determined in each case by X-ray and clinical examination, great care being given during the early ambulatory period when an abduction cast or walking caliper is used lest the graft be broken and failure result.

If non union exists with absorption of the neck, the more recent operations of Bracket and Whitman are excellent.

When the former operation is employed the remaining head is turned out and the freshened distal end fitted into it by abducting the leg and obtaining fixation in a cast. The Whitman operation removes the head. The greater trochanter is best detached in both operations and sutured or stitched at a point lower and opposite the lesser trochanter. The postoperative care following open operation is essentially the same as following recent fractures.

With the full co-operation of the patient and sufficient time the surgeon has before him the means of improving the rather discouraging results that have been obvious in the past in the care of fractured hips and their complications. H. W. MEXTRAND

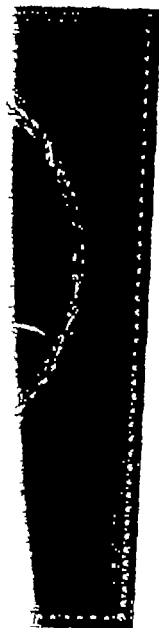


cut away behind to allow mobility. The duration of fixation in plaster should be left to the surgeon's judgment, although 6 months might be suggested as a minimum. A plaster cast, crutches or a walking caliper during the early ambulatory period should insure against possible coxa vara or non union. The value of repeated X-ray examination before and after reduction and during the ambulatory period should not be overlooked.

Coxa vara and non union are often the result of too early weight bearing. Conservative treatment, once coxa vara has occurred, is of little value. Open operation, osteotomy and prolonged postoperative fixation or traction in abduction is not always advisable inasmuch as many of these patients are aged and weakened by previous confinement. It is often advisable to accept the deformity and when recognized early attempt to prevent its increase by means of a walking caliper or crutches and elevation of the shoe on the sound leg.

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# MASTER SURGEONS OF AMERICA

GEORGE A BINGHAM

THE writing of a biographical note upon the life of a dear friend now departed can never be an easy or a pleasant undertaking. It can only be a task, a melancholy duty even if undertaken as a labor of love. It rouses regretful memories of days of pleasant association irrevocably gone in the work of what was in its day one of the very best of the proprietary schools of medicine on this continent, Trinity Medical College Toronto when that particular stage in the development of medical teaching and in the production of a useful body of practitioners, was serving the public interest well and paving the way for the advent during the past twenty years or so of the still more developed type of teaching institution with which we have become familiar.

No one of the scores of teachers, in Canada and the United States, who have watched the transition and borne a personal part in both the older and the newer systems has filled a larger place or served his day and generation more worthily in both than the subject of this sketch.

Like very many of those in his chosen profession who have come to eminence in it Bingham came of sound Old Country yeoman stock. He was born in Durham County in the Province of Ontario on August 18 1860 the son of William and Elizabeth (Mills) Bingham of that Irish Presbyterian stock which has done so much for the other lands to which it has migrated. His early education was in the public schools and in the high school of his own county in Bowmanville Ontario. After qualifying as a public school teacher at the normal school Toronto he served as head master for two years in the public school of Hamorton Ontario then entered Trinity Medical College as an undergraduate in 1880 and after a distinguished course graduated in 1884 both in Trinity University as M.D. C.M. and in the University of Toronto as M.B. After some postgraduate work in New York, and a brief period of practice at Manila, Ontario near his old home where he promptly became a great favorite in his new career he returned to Toronto at the request of the late Dean Walter B. Gelfue M.D. of his old school to begin his career as medical teacher in the dissecting room of his Alma Mater. From 1884 to 1889 he was demonstrator of anatomy. In 1890 he became professor of practical anatomy and in 1892 professor of surgical anatomy as successor to Dr. Luke Teakey.



His lamented death occurred on March 1 1922 His health had been for some months indifferent, and he was on the point of acceding to the urgent advice of some of his confrères to give up his winter work and classes and go south to recuperate when on February 9 he fell ill with a sudden pneumonia. The disease, though severe in onset ran an unexpectedly favorable course till after an early pseudo-crisis symptoms of exhaustion developed ending in coma and death.

His last thoughts were of his classes and his work, even as his students had always held first place in his sympathy and friendships. His best monument is the place he holds in the respect and affections of countless hearts now scattered over all parts of Canada and the United States, and in Mission Fields and in Public Services in all parts of our widespread Empire, and outside it as well.

His funeral service was held in Convocation Hall at the University he had served so well and lectures were suspended for the day in respect to his memory

J T FOTHERINGHAM.



# TRANSACTIONS OF SOCIETIES

## CHICAGO GYNICOLOGICAL SOCIETY

REGULAR MEETING HELD NOVEMBER 16 1923 DR. BACON PRESIDING

### SYMPOSIUM ON OBSTETRICAL TEACHING

DR. C. F. BACON, CHAIRMAN. The program committee has taken as the first program of the year symposium on obstetrical teaching. Is the anything wrong with obstetrical teaching if so what is the matter and how can it be corrected?

This subject is of importance because of the recent development in school in prenatal and postnatal clinics, and because of papers on reform in obstetrical teaching presented by well known authors.

The fifth year clinical work has of late years has not previously been considered. This fifth year has come to be recognized as one of the most important years of a woman are obliged to consult with teaching is done in the hospitals here the fifth year work is given.

So invited to participate in this program the deans of faculties heard of it previous to the election of fifth year committees. The rumors and secret of the Committee on Education of the American Medical Association were also notified but could not be present.

Dr. HILLMAN will give more or less general introduction to this subject.

The United States government has recently enacted laws which has for its purpose an improvement in the practice of obstetrics.

This new act, the Shephard-Lowner law passed without the support of the organized medical profession. Many times has appropriated money which is necessary to put into the operation of the law. Certain states have refused to participate as a result of the active opposition of local medical societies.

These facts indicate widespread dissatisfaction with obstetrics as it is now practiced. This opinion is not shared by the medical profession as a whole.

The opponent of this legislation has urged against it states rights, bureaucracy, paternalism and a tendency toward state medicine. These arguments have been advanced without investigation of the possibility that there may be some justification for the implied criticism of the law.

A recent survey made in the state of New Jersey comparing the results in confinements conducted by midwives with cases delivered by doctors has caused much to be learned from the standpoint of the physician.

A number of years ago Williams has criticized the teaching of obstetrics in this country and concluded that instruction in this branch of medicine was not on par with that in other departments. Since that time many of the faults he found have been corrected and in the class of medical schools the subject is usually allotted sufficient amount of time and the student works given in a satisfactory manner. But obstetrics cannot be learned from book.

In some of the larger hospitals in Chicago some of the internes have no experience in the obstetrical work. In the Cook County Hospital only twenty-four out of the sixty interns have any obstetrical experience.

The fifth year committees in three of the larger medical schools of the city certify these hospitals for fifth year work and take no special cognizance of the obstetrical experience obtained by the students in the smaller hospitals.

It is believed that an inquiry into the amount of clinical teaching given at the bedside and in the labor room will indicate a deficiency in the most important method of instruction.

If it is true that there is need for more efficient obstetrical teaching movement in that direction could be suggested more appropriately in this society.

### DISCUSSION

DR. FREDERICK W. RUSH, Medical College. The out-patient department, if properly managed, affords an excellent opportunity for clinical teaching. The head of each department should be familiar with this work. Those departments are most successful in which the head of the department actually does regular work. His regular attendants in the dispensary.

The need for hospital beds differs in the special department of medical school. A smaller number of beds is required for each department as the obstetrics department than is required for the general surgery department. Each of the department should have a definite definite number of beds for the study of cases.

Most of the teaching in obstetrics has been done heretofore through the out-patient department with very few beds available in the college hospital. This means that sufficient pathological cases were not

available for the instruction of the staff as well as the students, and the head of the department had difficulty in building up his department.

There should be an increase in beds devoted to obstetrical patients.

DR. N. SPROAT HEAVY. The public are demanding better medical education and better obstetrical service. I was recently in a small town in Illinois and was interested to hear the doctors say that the people are demanding more hospital accommodations for obstetrical work. There is a greater demand all the time for hospital space for delivery. Patients are coming for urine and blood pressure examinations and these country doctors are beginning to wake up. They are asking obstetricians to read papers on obstetrical subjects; they want to know how to do obstetrics. It is all very encouraging.

As I look around the audience tonight it seems to me that we have here one solution of the problem with regard to obstetrical teaching. Except for Drs. Brown, Irons, and Elliott I don't see anybody except those who are here usually the obstetricians. We need help from the other departments in our medical schools.

Obstetrics has been the stepdaughter of medicine. I, the old times, each man put a thousand dollars in the medical school and the biggest man with the strongest pull taught surgery. The next man got medicine or eye and ear and the last man was some general practitioner invited in who without being charged anything for his stock in the medical school got to teach obstetrics. Nobody was even interested in his teaching, and no beds were assigned him in the hospitals because the wailing might disturb the surgical patients.

The professors of surgery and of medicine today were named on that sort of pay and that is the attitude they have now toward obstetrics. You know how willing they all are to refer an obstetrical case if it does not require caesarean section.

A lot of our present difficulty with obstetrical results is due to the fact that men have been taught in the out-patient department with the lowest interns on the obstetrical staff as teachers.

Usually the only clinical teaching that the heads of obstetrical departments do except for the demonstration of some pathology in pregnancy is either a caesarean section or some difficult forceps case. And that is not the kind of teaching that the students need. They need the ordinary cases to become familiar with normal cases and slight deviations from the normal.

DR. JOSEPH B. DELIA. Northwestern University Medical School. Is the mortality and morbidity of obstetrical practice in the United States as great as the proponents of the Shepard-Towner bill have led the public and some of the medical men to believe. And, are the midwives doing better work than the doctors?

And, it is true that the mortality and morbidity of obstetrics are both so high, why are they so high? Why jump on the teaching as the single and only

cause of the high mortality? There are other reasons to my mind, much more fundamental than the teaching that causes the present deplorably high mortality and morbidity. It is the disrespect, the disappreciation, the disparagement in which obstetrics has been held from time immemorial. It was considered disgraceful for a man to go into obstetrics.

Up to the year 1850 a man who did obstetrics was not permitted to join the Royal College of Surgeons in London. And if a member of the Royal College of Surgeons was seen talking to an obstetrician on the street his resignation was requested.

I would suggest, as the outgrowth of this meeting, that a committee be appointed to investigate the causes of the present high mortality and morbidity in obstetrics.

Some years ago I was chairman of a committee appointed by the American Medical Association to report on a standard curriculum for medical schools in the United States, the amount of time to be devoted to obstetrics and gynecology. When we made our first lists for all the subjects, we found we would need years of a student's time working 9 months of the year every day including Sunday in order to teach him as much as we thought he ought to know. We finally compromised on 4,000 hours and this number has been reduced since.

Some of the reasons for the inefficiency of our teaching are preventable some are not. A man wants to do caesareans and forceps and see pathological conditions. It is very difficult to get enough material together in one place so that it will pay a man to go and see it. Therefore, we need better obstetrical hospitals. This is up to the public.

If the people instead of bothering about a Shepard-Towner bill, had got together to see that teaching hospitals were provided they would not need any Shepard-Towner bill.

At the Northwestern University Medical School the work in obstetrics is given in the senior and junior years. Even in the second year some of the men get a chance to see obstetrical cases. The didactic teaching of the 2 years is divided among the six teachers. The class is divided into sections. The juniors and seniors are divided into three sections of about twenty-five each. The teachers alternate changing each semester to the junior and the senior classes. The teachers use in addition to the book, specimens and pelvis. There are two lectures a week, that is, in the 2 years 20 hours.

Of the manikin work each student gets from 18 to 24 hours in classes of six or eight. The senior class is divided into groups of six or eight, and these are drilled on the manikin. All operations that can be done on a manikin are rehearsed over and over again.

We offer no required laboratory courses in obstetrics but we have an optional course. It is given by a man who is schooled in obstetrical pathology. That is not very well attended. The men have more than they can do otherwise. We don't emphasize as much perhaps as we might the laboratory side of obstetrics. We emphasize the practical side.

Northwestern has always striven to develop practical men, men who could be turned loose upon the public with safety.

While we would like to give more pathology than we are giving in the regular course, still we don't insist so much on the laboratory work.

The practical work we offer the students requires an attendance of 10 weeks at the dispensary where they take this much maligned teaching which Dr. Heaney condemned. I consider the out-patient obstetrics an essential and invaluable part of the general scheme. I would regret very much to see the dispensary work taken out of our curriculum.

Done as we do it I am convinced (and more convinced every year by the praises of the men who come back after being out 5 or 20 years) that the out-patient teaching is really the most important individual portion of our teaching. They say that at the old dispensary on Maxwell Street they learned how to take care of the cases in the home where the majority of babies are born.

We have had men that are hospital bred who are paralyzed when put up against an obstetrical problem in a shed or shack or barn. The men we turn out can handle obstetrics very satisfactorily without any sterile towels, without anything but a couple of sterile basins—they don't even have to be sterile—and with a few pairs of gloves and a reason for full of cotton. We have definite technique, such as in printed form and supplied to each man so that the traditions of the founder of the dispensary are handed down.

In addition to the 10 weeks practical work in the dispensary the Northwestern students, and also those from the University of Illinois, do take this course, re-entitled to 1 week's observation in the hospital. The University of Illinois has not granted the men leave for more than 2 weeks so that they get very few of the Illinois men over at the Lying-in. But a large number of the Northwestern men spend the extra week there at the dispensary and once at the hospital.

In addition to that, the students are invited up to the hospital for special cases. We have prenatal clinics and prenatal work at the Maxwell Street Dispensary. They see forceps cases, venereal, puerperal infections, and postpartum hemorrhage. They know how to prevent infection in hospital and dispensary service.

If those men who graduate don't practice obstetrics which is sad, it is not our fault. I know there are a great many hospitals and teaching institutions in the United States that give just as good work as we do. I know the other hospitals may give it differently but they give it just as well. So the fault is not entirely with the teaching.

Dr. BERTHA VAN HOOVER, Loyola University: Our obstetricians do not present that the gateway to obstetrics is through the surgical door. Every obstetrical case is surgical. Every surgeon feels that curettage in the kitchen is disgraceful. But no obstetrician feels that the delivery of a patient in

home is not fine. I think that obstetrics must be hospitalized because it is a branch of surgery.

One of the reasons why the women are up in arms, and perhaps the reason we have the Shepard-Towner bill, is because women are tired of seeing their daughters and their sisters suffering. We should pay more attention to anesthesia in obstetrics.

I think anesthesia is an absolute necessity not only for the best teaching, but to satisfy the great demand of the public for painless childbirth.

Dr. HEANEY: Why if obstetrics is valuably taught in the home, should not the teachers of internal medicine and surgery take up teaching in the out-patient department and show the students how to attend cases of pneumonia in the home for the sake of adapting home conditions to the needs of their cases in future practice?

Dr. DeLEE: Feeling so keenly the value of taking care of the patients in the home, I have recommended to our medical department that they establish an out-clinic for medicine. I do not want to be on record as opposed to the hospital movement. But, gentlemen, you have to meet conditions as they are and not as they should be.

Ninety-five per cent of the babies are still being born at home and not in the hospitals.

Dr. HEANEY: They will be as long as that is taught as an ideal method.

Dr. DeLEE: That is simply a transition point. If students were taught how to do appendix operations in the kitchen the mortality would be reduced throughout the United States.

Dr. C. S. BACON: In the University of Illinois we give 300 hours to obstetrics beside the miscare work of 2 weeks when the students are at the Lying-in Hospital Dispensary or at one of the affiliated hospitals. Half of the 300 hours is given to didactic work, half in the third year and half in the fourth. This work is again subdivided. There is lecture work of 32 hours and 64 hours of quiz work. The labors are conducted to quite an extent by the interns. That is the weakness of our system. The hospitals affiliated with our schools, where the majority of our fifth-year men work, have a certain amount of supervision. In one of the hospitals we have about a thousand cases a year. Each man has an opportunity of having delivered under his personal supervision about 25 cases. I feel that most of these interns can be trusted with ordinary cases.

Even the cases they see where great mistakes are made in delivery are not without some value because they are not deterred from making criticisms and learning from the mistakes that they see.

Dr. BACON: As you all know, I am very recently acting as dean of students, and so it is obvious that I can't offer very much in constructive statements. I remember with a great deal of pleasure the course of obstetrical teaching I had with Dr. DeLee. We all struggled for a chance to go to the Maxwell Street Dispensary.

I would like to ask Dr. DeLee two questions. Having in mind the opportunities for teaching as he has

described them in instruction of the students, would be feel that additional teaching of the hospitalized cases would be desirable?

Dr. DeLee: Yes.

Dr. Isaacs: And if so to how great an extent?

Dr. DeLee: I think if they have 3 weeks in the hospital and 2 weeks in the dispensary they are well taken care of.

Dr. Isaacs: I would like to ask Dr. DeLee whether in his opinion the instruction of students by the internes in the out patient department is a satisfactory way of teaching students?

Dr. DeLee: No. It is not fully satisfactory but it is the best we can do at present.

Dr. Isaacs: Assuming that each class consists of one hundred men and assuming that hospital teaching is desirable to a greater extent than it is offered at the present time how many beds would be required?

Should all primiparae be hospitalized for their first delivery?

Dr. DeLee: The minimum would be 100 beds. I could say a bed for every student.

Dr. Heaney: One hundred beds was the answer I got in every place I asked. At Sloane and the Brooklyn Lying-in, they don't allow any woman to receive out patient attention if she is a primipara or if she had a pathological delivery or pregnancy the last time.

Dr. DeLee: I think there might be some value in the argument in having the primiparae delivered at the hospital, because pathology is more common in the primipara. If you leave her the way she should be, she is primipara all the time. The fact that a woman becomes a multipara is rather a confession of error in our practice.

I think however that with our system at the dispensary we can deliver a large number of primiparae safely at home.

I want to say there are dangers in hospitalization. The Metropolitan Life Insurance Company collected two thousand cases taken care of by the Maternity Center of New York, traced them to their homes and found that the highest mortality was in those cases that went to the hospital for delivery. The women who were delivered at home and had doctors and midwives at home had the lowest mortality. That is well worth thinking about.

Dr. Isaacs: I would like to ask Dr. DeLee whether there would not be a selection in those cases.

Dr. DeLee: Just the women who attended the prenatal clinics.

Dr. Heaney: When a hospital is accepted as a proper place for a man to spend his fifth year what qualifications do you ask from their obstetrical department if any?

Comparing the difficulty of teaching pathology in obstetrics, what percentage of all the internists that general practitioners in the country will ever meet in his lifetime is required to be the hospital?

And how essential is it that pathology be taught in hospital to men who are going to be general

practitioners? Ambulatory cases coming to the dispensary cannot be thoroughly taught without having a single hospital bed and, in your opinion, can obstetrics be taught that way?

Dr. Bacon: The university has members of its obstetrical staff on the staff in each affiliated hospital. These men have a certain voice at least in the teaching and are expected to have the chief say in regard to the teaching of obstetrics in those hospitals.

It is true that many of our students take their internship in other hospitals not affiliated with the university. There we have to accept the hospitals that are accepted by the American Medical Association and by the committee that we have in the city of which Dr. Elliott is the chairman. This committee is trying to bring about some uniformity in the standards of hospitals to which we have to send our students.

Dr. Heaney: Is it not true that hospitals are accepted as accredited when they have no obstetrics whatever?

Dr. Bacon: I am sorry to say that is true.

Dr. E. V. L. Brown: University of Illinois. The situation in which you find yourselves as obstetricians is practically the same as that in which men in all other fields find themselves—lack of adequate quarters, material and men. One of the organization evils is our separate isolated hospital which has no integral relationship to the general hospital, to the medical school or to the university. The same type of individualism is found in England and France in contrast to the institutional centralization found in Germany and Austria.

Our universities will probably soon completely dominate medical education and with it, the fifth year as they now do the first four and will provide and control the physical properties, the staff, the material, and the teaching done. A possible year could include three months each in medicine and surgery, two months for obstetrics, gynecology, orthopedics and dermatology, one month for eye, ear, nose and throat. This division is only suggested to show that all branches can be covered though, of course very inadequately.

Dr. Elliott: I am quite sure that we do not know exactly what we are aiming at in undergraduate medical education. At the end of 3 years the student is not a finished product. He cannot be a competent obstetrician any more than a competent internist or surgeon.

The fact mentioned tonight that people are becoming more accustomed to hospitals for obstetrical care offers a possibility of satisfactorily solving one of your problems in obstetrical practice. In my relatively short experience I have noted a marked increase in the percentage of obstetrical cases, both normal and pathological, that go to hospitals. If it is true as stated that the mortality rate in obstetrical practice in hospitals is higher than that outside the hospitals there must be some other reason for it than the mere fact that they were hospitalized.

T my mind women should not be confined in the home any more than surgical operations should be performed there.

Dr. IRONS May I take exception just a moment. I think we have a very definite ideal in medicine and that is the training of good general practitioners in medicine.

I think the student should be better prepared in obstetrics than in surgery or medicine. He should be able to do special obstetrical work because he has got to deliver those women. He has got to do it properly and carefully now. He ought not to be doing surgery nor setting himself up as a consultant in medicine within his first five years of practice in the least.

It is obvious that a man going out into the practice of medicine should be able to deliver a woman in confinement. I assume that man to start in the practice of medicine. A general practitioner should be able to do this. But he should be able to take care of pneumonia properly or be able to set a leg properly.

Dr. MCGUIRE Loyola University. I had my medical education in Dublin. We did not get a third of the didactic training abroad that you do here. The first six months every detail in connection with the patient's physical condition as supposed to be noted with the eye. We had to make our diagnosis by the touch of the hand, by getting a mental picture. We were especially prepared for our final examination. This examination lasted many months from ten to fifteen days of six hours daily. The examinations were taken from strange universities.

Our obstetrical training consisted of six weeks of internship in a hospital with a wealth of clinical material. We also had three months' service in the out-patient department. There was didactic course in obstetrics in the morning for those six weeks. The whole object of the institution is to train practical men.

At Loyola we strive to get fifty beds, if possible, in the dispensary of the school. We should have six weeks' course and those men should have an intensive obstetrical course combined with pediatrics. We will try and give them some deliveries on the outside if we can. We used to consider that if a man could get 30 or 40 deliveries, preferably under supervision at the hospital, his training was better than if he were let loose in the out-training department doing normal deliveries alone.

Dr. BACON D. Lee is chairman of the committee on prenatal clinics that was organized under the supervision of the Health Department.

Dr. W. G. LEE Regarding the prenatal clinics. There is at the present time an increased recognition of the value of early examination of the pregnant woman.

Prenatal clinics have been started largely from recognition on the part of a few that many cases first seen at labor were in much more serious condition than if early knowledge had led to prophylactic treatment.

Prenatal work in this city has been started in several different hospitals. Although a number of hospitals have started them, some only take care of the cases that they later will deliver so it seemed fitting that others having also an educational function should take care of the people at large, wherever labor was to be conducted.

The Department of Health has established 10 or three centers. It is now the desire of this Department to have additional centers established in regions not covered otherwise, to have the technique uniform and on a high plane and to try to have all prenatal work follow the same general course with similar history charts so that all centers may benefit from the work of a very individual one.

The Advisory Prenatal committee has been working along this line, there being on this committee representatives from the different medical schools. They thus are attempting to see that the poor have a opportunity to receive the advantages of skilled care. Attention to these patients got hospitals where they may be available for teaching purposes and in this way they reach the proper hospital for their particular race, color or religion. This work is an aid in the gathering of statistics. Thus necessary charity work so supervised can be sifted out from work that should not be handled by charitable institutions.

To revert now to the general subject of tonight's meeting: The County Hospital staff passes in review the highest results, as it were, produced by our medical schools, because the County service is sought after by the graduates of all the schools, and is graded by competitive examination.

I think the feeling there is universal that obstetrical training of the medical students making County is quite inadequate. We can only wonder if this is the case with those who represent the highest attainment of our medical schools, what deficiencies would be revealed in the lower stand men who are not able to make a place by this competitive examination.

Dr. JOSEPH L. BAKER Director of Prenatal Clinics of the Infant Welfare Society. In small way I can offer a concrete example of the difference between undergraduate teaching in Chicago schools and schools elsewhere. Michael Reese hospital is reserving not to exceed four interne positions for out-of-town men. Of the four men who came in from out-of-town schools in this past year, each coming from a different school, 3, within 3 months, are so dissatisfied with our junior service that they wanted to quit. And the reason was that they were doing work now as junior internes that they had been doing as third and fourth year students in the schools from which they had come. And yet for years our local graduates have been competing rather eagerly for the Michael Reese internships.

Our college undergraduates, in their third or fourth years, are wasting much of their time on the benches and are not getting bedside training. That applies particularly in obstetrics.

I believe that the fundamental fallacy in home delivery teaching of obstetrics is that it is second best. For twenty odd years here in Chicago the Lying in service has given a home delivery teaching so well that the importance of hospital teaching in obstetrics for undergraduates has not been realized. I believe that the fundamental place for the teaching of obstetrics is in the hospital. I grant you there may be a very desirable place for out patient teaching, but only as second best.

Answering Dr. Irons' question about the primipara being delivered in the hospital. I firmly subscribe to the Sloane procedure. Not only primiparae but multiparae with a pathological history should, whenever possible, be hospitalized.

Dr. Bacon asked me to speak on prenatal development. There is no doubt that here is where obstetrical teaching should begin. The student who is taught to lay on a forceps is being taught the superstructure of obstetrics. He should be taught to measure and to palpate, to recognize disproportion long before labor sets in, to recognize toxemias and accidental complications. The prenatal clinics should be utilized as teaching centers. The obvious place for this is in connection with the school.

I believe in really teaching our students obstetrics. Those who are teaching the student to examine by the rectal route rather than the vaginal route are sorely handicapping their students. I believe that in all regulated institutions and likewise in the home under proper conditions the vaginal examination is absolutely as safe as the rectal. The student will learn what he needs to get—the state of the cervix, the position of the head and the state of the pelvis from within.

Dr. DAWSON: I think that you men who are in charge of the fifth year committees and who are deans of schools and who have to do with the placing of internes, should do something to make it clear to those who manage hospitals that a certain amount of practical work is essential for your fifth year student. A certain number of free cases should be provided.

They are hampered in getting enough cases for them to deliver themselves because the lay people who run hospitals do not know what students need. They won't know until it is borne in on them by a sufficient

expression of opinion. We must get home to them the fact that we owe these internes a duty and if we do not perform that duty we are failing as a source of instruction.

Dr. FITZ PATRICK, Member of Examining Board of the State of Illinois: The fifth year requirement, now written into law, makes it incumbent upon the hospital staff to organize and give special and satisfactory instruction to the internes, or be denied recognition by the Board of Medical Examiners. This, compelling them to hire resident physicians at considerable expense, based upon the experience of Pennsylvania where the compulsory internship has been in force for the past seven years, will not be tolerated by Board of Trustees with deficit on hand which could have been lightened by staff cooperation.

The fifth year requirement will materially assist the valuable work so ably undertaken by the American College of Surgeons and later by the American Medical Association in their efforts to establish a standard for hospitals.

Dr. DELER: I would resolve that the Chicago Gynecological Society appoint a committee to investigate the causes of the present high mortality and morbidity in obstetrical cases in the mother and the baby.

Is it entirely due to lack of good teaching? Is it due to the inherent difficulties of practicing obstetrics, to the hospitalization of cases, to puerperal infections in hospitals, to the greater frequency of performing cesarean section, to the fact that general surgeons are doing obstetrics in the extreme cases, or to the general higher valuation of the baby's life which impels the accoucheur to attempt operations dangerous to the mother?

The above motion was carried and the committee appointed.

Dr. HEAVEN: I should like to have resolution passed that committee be appointed to investigate the causes of fetal and maternal morbidity and mortality and a second committee to investigate the relative importance of obstetrics in the medical curriculum.

The motion was carried and the committees appointed.

# THE SURGEON'S LIBRARY

## OLD MASTERPIECES IN SURGERY

BY ALFRED J. BROWN, M.D., F.A.C.S., OF A. VERRILL

### THE SURGERY OF ALBUCAZIS

WITH the fall of Graeco-Roman civilization at the beginning of the middle ages, the germ of that civilization with its culture and learning was transferred to the Arabians and by them fostered during the period. The Arabians and other Orientals were indebted for preserving medical science among other sciences, and keeping it alive to be handed back to bloom again in an occidental civilization with the Renaissance. During the middle ages the Hippocratic and Galenic systems of medicine were the most important and but little was done to add to them. However the period did see the birth of the separation of medicine and surgery—though both were practiced, not to the same extent to be sure by the same individual.

The latter part of the middle ages produced Chasif ben Abbas Abul Casim el Zahra (Albucasis) Alahara son, Albucasis) of Elahara (Zahra) near Cordova, who was a Spanish-Arabian physician born 936 and died 1013. His compendium ("Altaf") was mainly copied from the medicine of the Greeks. The portion devoted to surgery was an advance over Graeco-Roman methods. This surgery translated into Latin, as first printed in 1497, the second edition, here illustrated, as published by Bonetus Lorietellus for Oct. Scotus helva, Venice 1734, p. 300.

The surgery consists of a prologue and three main parts. In the prologue Albucasis emphasizes the value of surgery and decries the hands of physicians who speak also of the necessity of knowledge of anatomy. By citing examples of improper surgical handling of cases he emphasizes these points.

The Surgery proper consists of three parts: (1) The use of the cautery both actual and medicinal; (2) operations with the knife and exploratory puncture—excision, removal of foreign bodies, principally arrows, etc.; (3) reduction of fractures and dislocations and the cure of sprains.

The cautery appears to be cure-all and is indicated in nearly all diseases which are considered in the realm of internal medicine. For each part of the body and for each disease a different form of instrument seems to be indicated and the shapes of the cautery blades are many and varied. The directions for the use of an iron cautery are distinct from those for a gold cautery and of the two the gold is stated to be the more difficult to use. The actual cautery is

indicated as more simple, and capable of less harm than the medicinal. As to its general indications, it appears to be useful for everything—headache, toothache, popliteal epilepsy, melancholia, cancer, and diseases of the eyelids (in which both the actual and medicinal cautery are used). It is also advocated for pleurisy, dropsy, hemorrhoids, fistula in ano, scalds, and as an adjuvant in fractures and dislocations. Hernia is treated by reduction of the mass and cauterization, being careful the intestines do not escape. The patient is kept in bed 40 days and then convalesces for 40 days more. He excises cancer with cautery. The cautery is also recommended for hemorrhoids. For each of these uses most careful detailed directions as to the use of the instrument are given together with a drawing of the form of the instrument to be used. In some diseases, the number, size and shape of the spots to be made on the skin are illustrated. The use of the cautery takes up the major portion of the book.

In the second part cutting operations are not strongly advocated except phlebotomy which is usually used. Trachoma was common and many operations for incurable eyelashes and adherent lids are described. Ranula is described and removed by lithotomy. Vesical stones are removed by lithotomy. Intestinal wounds are sutured with small threads derived from the intestinal coats. He is exceedingly cautious about high amputation. Arteries are ligated continuously in wounds and different forms of suture are described. Obstructions and ischaemic gangrene are considered carefully. Extraction of arrows is taken up in detail and the forceps for their removal are illustrated.

In the third part, fractures and dislocations are discussed. Reduction is almost entirely manual and the machines, so popular later are neither described nor illustrated. Various ointments are used to soften the parts before reduction. Dislocation of the shoulder he describes three types. The first and most common, an inferior dislocation; the second a dislocation upward toward the chest; and the third a dislocation upward. He further states that posterior dislocation cannot occur because of the scapula and anterior dislocation because of the nerves. It is interesting to note that the second method of reduction of dislocation of the shoulder described is the method of the best in the anilla.

The translation from the Arabic into Latin was made by Gerhard of Cremona born 1114, died 1167.







## REVIEWS OF NEW BOOKS IN GYNECOLOGY AND OBSTETRICS

By GEORGE GILLHORN M.D. F.A.C.S. St. Louis, Missouri

THE publication of works, in which obstetrics and gynecology are treated conjointly seems to me of the highest significance. Some 50 years ago Peter Moeller of Berne, and a little later Schauta, of Vienna, attempted to encompass the two branches in a single volume but their endeavors received little encouragement. In 1914, Luepmann, of Berlin conceived the idea of a pretentious work of a greater gynecology in which the two sister sciences would be represented in the same intimate connection which they occupy in actual life. Two volumes had appeared (and were reviewed in these pages) when the war put an end to this undertaking as it did to so many other good things.

The idea, however, of the close union of obstetrics and gynecology in book form was intrinsically too sound to die. In 1921 Fairbairn, of London, edited, with the help of numerous able collaborators, an imposing volume on obstetrics and gynecology the excellence of which was recognized in a previous review. And now two new works—one in German, the other in English—have appeared which will still further consolidate the unification of gynecology and obstetrics.

Halban, of Vienna, and Seitz, of Frankfurt, with a staff of seventy collaborators, have given their respective work the title of *Biology and Pathology of Women*. The editors point out in the preface that the pathological-anatomical conception of disease with its accentuation of largely morphological changes, which until recently has held undisputed sway has not been all sufficient to explain satisfactorily the totality of morbid disturbances. A number of new factors demand attention. Serology and bacteriology were the first to be considered. Physiological research, particularly in the domain of endocrinology followed. The rôle of constitution and heredity in the production of disease began to be more clearly recognized. The influence of the environment and the greater participation of women in industry added their quota, and, finally the effect of purely psychic causes could not be ignored. It is true that a definite evaluation of all these various factors is as yet impossible, but this much is certain that *biological thinking must henceforth be the basis of medicine*. Applied to gynecology this means that in the teaching and practice of gynecology not only the diseases of the female genital organs should be dealt with but that everything should be considered which from the moment of conception to the grave may have an influence on the origin and treatment of these diseases. That gynecology falls automatically

into this scheme of biological conception requires no special comment.

The first three installments of this imposing work have thus far appeared in print. To enumerate their contents briefly Halban discusses the general symptomatology and the principles of diagnosis in gynecology. The various forms and localizations of pain are carefully analyzed enlargement of the abdomen and its different causes, abnormal bleeding, amenorrhea, leucorrhoea, and symptoms pointing to the urinary organs compose the rest of this well written chapter.

Polano contributes a beautifully illustrated section on methods of examination, the newer methods of pneumoperitoneum and tubal insufflation receive due attention.

Koehler supplies a discussion of 140 pages on medicinal, local and organotherapeutic remedies. To us who have grown up in the surgical era of gynecology it may seem on first thought that we need but very few drugs in practice; in reality there is in actual use an enormous number of antiseptics, haemostatics, uterotonics, organic preparations, narcotics, aphrodisiacs and antiaphrodisiacs, etc. and the study of this chapter which furnishes details of the nature, indications, and effects of these various remedies proves highly profitable.

To Linder has been entrusted the important subject of non specific protentherapy with its astounding possibilities of mobilizing the defensive apparatus of the organism.

Seitz adds a monographic dissertation of 174 pages on X-ray and radium treatment profusely illustrated and reflecting the rich experience of this recognized authority on the subject.

The history of gynecology (and obstetrics) from its earliest prehistoric beginnings to the end of the 18th century has been written by Fischer and reveals on every page the thorough knowledge of the author. The contributions of every nation of the world, including China and Japan, are here recorded separately and in detail. It would have appeared preferable to me to follow up currents and developments through the ages and though we might thereby have missed some of the details, we would have gained a clearer bird's-eye view of the vast material.

In the discussion of human embryology Lubarach has included the most recent additions to our knowledge.

The chapter on types and anomalies of constitution is from the authoritative pen of Mithras and is probably the last work that this well known author wrote before his death. Associated with this chapter is a section on disturbances of nutrition and growth by Guggenberger in which several of the manifestations of endocrine disorders (gigantism, dwarfism, castra

Serg. Gynek. u. Obst. 1921 822, 880

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Biologie und Pathologie des Weibes. Ein Handbuch der Frauenheilkunde und Geburtshilfe. Von Georg Halban und Ludwig Seitz. Berlin und Vienna. Urban & Schwarzenberg 1921

tion, (c) are discussed together with osteomalacia and rickets.

I wish I could stretch the space allotted to book reviews, to include selections from this monumental work which eventually will be completed in eight large volumes. The value of this hand book cannot be overestimated. The names of the contributors who have not yet been heard from but all of whom have made their mark in contemporary literature guarantee that the future installments will be on a par with the excellence of the pages in hand. This is a work pre-eminently suited for the specialist, the man engaged in actual practice of gynecology and obstetrics. It is a reliable guide. To him who wishes to do research work, it represents an up-to-date reference work on all achievements of the subject. The exhaustive bibliography at the end of each chapter predominantly but by no means exclusively of German literature will be extremely useful to the student.

The second book mentioned at the beginning, has been written by Herr Hendry Ferguson, and Young the former of Glasgow the latter of Edinburgh. Their *Combined Handbook of Obstetrics and Gynecology* is addressed to the medical student and it serves a entirely different purpose from that of the *Handbook* reviewed above. It really has been a textbook in one cover with the emphasis laid on obstetrics which more than two of the approximately 1000 pages are devoted. In looking through this omnibus textbook, one feels that the available space might have been divided more evenly. The chapter on examination, for instance is much too brief and contains but two few illustrations. The discussion on ductless gland I believe might have been made longer in view of their decided influence on the human economy. As such pertain to the total influence of pregnancy upon the maternal metabolism is intensely interesting. The methods of measuring the pelvis are described and depicted under the heading of "Anatomical

long pelvis." Would they not be more appropriate in the chapter on prenatal examination? The amniotic forceps is apparently much in vogue with the authors to judge from the space and illustrations given to it. In looking the uterus after cesarean section, craniotomy is not altogether relied upon and a number of thorough and thorough methods of cure and laceration are inserted for reinforcement. In the gynecological part of the book the pathology and symptomatology of the various conditions is very well presented but the discussion of treatment seems inadequately brief. In the matter of illustrations, the text does not follow the standard set by our own textbooks.

While, however, it is this book stands out among other textbooks, as the connecting chapter between obstetrics and gynecology. In this chapter in which

general review of the intimate relationships between the two departments is given, the student of gynecology is impressed with the importance of thorough knowledge of obstetrics and with the fact that the great majority of ailments encountered in gynecological practice is the result of infections and injuries contracted during parturition. Signs and symptoms that in delivery are the main factors which must be studied. Abruptio and hurried extraction of the placenta account for many cases of subsequent prolapse. Skilled obstetrical and gynecological knowledge is required in many problems of diagnosis. Among other examples the authors refer to the diagnosis of early and late pregnancy and its differentiation from various gynecological conditions such as hydatidiform mole, abortion, ovarian cyst, fibromyoma, distended bladder, pregnancy complicated by ovarian tumor, ectopic gestation, induratio, pseudocyst.

In thus emphasizing the indivisibility of gynecology and obstetrics, the authors in my mind, have rendered distinct service to the medical student and indirectly to mankind. Sporadic attempts at the contrary notwithstanding, the logical union of the two sciences is becoming more firmly established and the time will come let us hope, when a separate department of obstetrics and gynecology in schools will be a thing of the past and the true specialist will be expert in greater gynecology.

A Combined Text-Book of Obstetrics and Gynecology. By J. M. Moore, M.D., F.R.C.S. (Ed.) (Author, Henry Young, M.D., F.R.C.S. (Ed.) (Editor). London: Livingstone, 1921. 1000 pp. 10s. 6d. American Edition: New York: Williams and Co., 1922.

# SURGERY, GYNECOLOGY AND OBSTETRICS

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## A BIOPHYSICAL LAW GOVERNING SURGICAL MORTALITY<sup>1</sup>

By GEORGE W. CRILE, M.D. F.A.C.S. CLEVELAND

IN the death of John Benjamin Murphy the world lost one of its greatest surgeons and the American surgical profession its leader. The light of his versatile genius had pointed the way to a rational surgery of the abdomen. It had made epochal progress in the surgery of the bones and joints. It had advanced the treatment of tuberculosis. It had made notable contributions to the surgery of the lungs. It had illumined the intricate fields of surgery of the nerves and of the blood vessels.

John B. Murphy was more than a master surgeon. He was a brilliant teacher and a talented author. The Murphy Clinic was the Mecca to which surgeons from all parts of the world came for inspiration. His clinical lectures in their lucidity, logical deductions, and originality were unequalled and from no other clinic have there issued so many original and practical contributions to surgery. Dr. Murphy's dicta regarding new procedures were always accepted with confidence in the knowledge that before applying them himself every step had been verified by painstaking researches—researches in which he was stimulated and encouraged by the co-operation of his constant collaborator, Mrs. Murphy.

Tonight we commemorate the services of this great surgeon-teacher-author. Since these qualities were based upon a keen interest and participation in original research, it would seem fitting on this occasion to offer as the subject of this oration a theory based upon

certain researches of my associates and myself in the Biophysical Laboratory of the Cleveland Clinic.

For many years medical science has been endeavoring to identify the form of energy that drives the organism of man and animals to discover the physical laws in accordance with which that energy operates and to determine the conditions which lead to progressive or immediate loss of energy and death.

Since the surgeon deals with the injured and acutely diseased man, since he opens the living organism to remove tumors, to overcome infections, to relieve obstructions and to correct deformities, since he modifies the organism by means of stimulants, sedatives, and anesthetics, the surgeon is peculiarly and more than any other individual in a position to learn at first hand the changes wrought within the organism by injury, by operation and by disease.

In the many efforts which have been made to find a fundamental law based alone on the observations of the physiologist and the pathologist, no premise has been formulated whereby the surgeon could interpret the vital processes. In the Cleveland Clinic, therefore, we have turned to physics in our search for light upon this fundamental problem, and it is my purpose on this occasion to present the summaries of experimental and clinical evidence in support of a physical law which governs the so-called vital processes of the organism.

<sup>1</sup>The Murphy oration delivered before the Clinical Congress of American College of Surgeons, Cleveland, October 1923.

Animals are transformers of energy: it follows, therefore, that animals must be operated by means of one or more of the following six forms of energy: (1) heat, (2) light, (3) gravitation, (4) intermolecular forces, (5) chemical energy, (6) electric energy.

It is obvious that the organism of a rabbit for example is not operated by heat energy, nor by light energy, nor by gravitational forces, nor by surface energy. It follows that the probable driving force of animals must be either electrical or chemical energy or a combination of both. We therefore propose the theory that animals are electro-chemical mechanisms. If this theory is tenable it must meet the following requirements:

1. That electricity is a constant phenomenon of living processes. This has long been known.

2. That the application of electricity to the muscles or glands, or to their nerve supply will cause them to perform their natural functions. This is a basic fact which is universally accepted by physiologists.

3. That the materials of which animals are constructed are specifically adapted to electrical processes. Certain known facts regarding the principal constituents of the body will be cited and new evidence submitted.

4. That in their structure and function the unit cells of the organism are adapted to fabricate to store and to discharge electricity. Certain generally accepted facts and certain new evidence which tend to establish this requirement will be offered.

5. That the organism as a whole is a bipolar electric mechanism built on the pattern of the unit cells, the unit cells being constructed on the pattern of the atom. Experimental data which tend to support this requirement will be offered.

6. That the normal and the pathological phenomena of man and animals can be interpreted in electro-chemical terms. Summaries of experimental researches undertaken to establish this point will be given.

#### THE ELECTRICAL SIGNIFICANCE OF CERTAIN CONSTITUENTS OF THE ANIMAL ORGANISM

Water which forms more than three-fourths of the body content has a high dielectric

constant. This property of water is responsible for the ionization of the infinite numbers of molecules which water holds in suspension or in solution. Water is also one of the most important catalysts.

*Electrolytic solutions and colloids* which make up the bulk of the body are especially adapted to electro-chemical processes.

*Hydrogen ions* Hydrogen ions permeate all living organisms. The slightest change in the hydrogen ion concentration fundamentally alters the organism, and hydrogen ions are of high electrical significance.

*Carbohydrates* are the source of the hydrogen ions which are released by means of oxidation.

*Lipoid films* Of the highest electric significance are the exquisitely thin, oil films which surround each of the trillions of cells which compose the body. For it is a well known physical fact that an oil film has a remarkable capacity for the accumulation of electric charges and that the thinner the film the higher its electric capacity. While each of the other essential constituents of the organism might play a rôle in an organism operated by some other form of energy, these lipid membranes are significant only in an organism which is operated by electrical forces.

*Nerve cells and nerve fibers* The animal organism as a whole is enmeshed in a network of highly specialized electric conductors—the nervous system. In its physical composition, therefore, the body is not only highly adapted to electrical processes, but its constituents in their various interrelations within the organism could not be of value in a mechanism operated by other forms of energy.

#### THE UNIT CELL AS AN ELECTRO-CHEMICAL MECHANISM

The unit of structure and of function is the cell. It is essential then to consider the operation of the cell as an electro-chemical unit.

The nucleus of the cell is comparatively acid, the cytoplasm is comparatively alkaline, the nucleus and the cytoplasm are separated by a semi-permeable film of very low conductivity. These characteristics of the cell indicate a difference in electric potential between the nucleus and the cytoplasm.

Thus, we may consider the cell as a bipolar mechanism the nucleus being the positive element, the cytoplasm the negative element. The oxidation in the nucleus is on a higher scale than the oxidation in the cytoplasm hence as the electric tension increases in the nucleus, the current breaks through the potential in the nucleus falls and in consequence the current is interrupted. Since the potential is again immediately restored by oxidation, we conceive that an interrupted current passes continually from the positive nucleus to the negative cytoplasm and in consequence a charge is accumulated on the surface films. These films of infinite thickness and of high dielectric capacity are peculiarly adapted to the storage and adaptive discharge of electric energy.

Why is the infinite thickness of these films of advantage? The work of the cell depends on its capacity for oxidation oxidation as we believe in turn depends on the difference of potential between the nucleus and cytoplasm the difference in potential depends on the voltage in the cell the voltage is in direct ratio to the electric charge the lipid films will hold the electric charge the lipid films will hold is dependent on the thickness of the film—the thinner the film the greater the charge. Dr Hugo Fricke of the Biophysics Department of the Cleveland Clinic Foundation has found that the film which surrounds the cells is  $4/10,000,000$  of a centimeter thick and that this lipid film has electric capacity of a high order viz 0.8 microfarads per square centimeter. We consider then that electricity keeps the flame of life burning in the cell and that the flame (oxidation) supplies the electricity used in operating the animal. In accordance with this conception, therefore the cell is an automatic mechanism. Life as we view it is the expression of the activity of this automatic mechanism.

In accordance with this conception, it is of infinite advantage to have the organism made up of trillions of units called cells, instead of an equal mass in a single unit. The advantage of the enormously great surface area of the lipid films surrounding the microscopic cells as compared with that of a single cell of equal mass is the corresponding increase

in the amount of the electric charge a corresponding increase in the amount of oxidation a corresponding increase in working capacity. Sir Arthur Thomson has estimated that there are 28 trillion cells in the human body. On the basis of even as small an average diameter as 30 microns the total surface area of the cells in the whole body would be equivalent to 9 acres. Meynert estimated that there are 1,200 million cells in the cerebral cortex thus, with an assumed average diameter of 30 microns the total surface area of the cortical cells of the brain would be 3.36 square meters. On the basis of Dr Fricke's calculation that the electric capacity of the cell membrane per square centimeter is 0.8 microfarads this total surface area would have a capacity equivalent to that of a Leyden jar made of glass 0.3 of a millimeter in thickness with a surface area of 114,000 square meters—the area of a city block.

A homely analogy would be a comparison of four surfaces secured for writing by squaring a huge log, as compared with the amount of writing surface secured by converting the log into paper. The crude pattern of nucleus and cytoplasm could be carried out in an animal with a range of activity comparable with that of a glacier—a log instead of a library.

Furthermore, a consideration of the cell as a bipolar electro-chemical unit indicates the dividing line between the living and the non-living. In accordance with this conception, the term living applies to the state in which there is an accumulation of electric energy on the membranes with a resultant polarization together with a mechanism for the release of that energy to perform work. There is no more energy per mass in the living than in the non-living. In the living, energy is captured and stored and made to run the organism in the non-living the same amount of energy exists, but is balanced, equalized inert, non-living.

Two streams of water flow swiftly each seeking the lowest level—equilibrium. One is caught and retarded thereby building up a potential energy of position as in a mill race in its further course this retardation is suddenly released and in the discharge of this

acquired potential energy of position a water wheel is turned and as a consequence of the turning of the wheel heat or light or electricity is generated. The stream which has thus acquired a difference of potential may be said to live as compared with the undisturbed river which takes its course unchecked toward complete equilibrium.

Two different metal plates and a suitable solution a separate unit are inert, non-living. Immerse the plates in the solution and connect them with wires so that a circuit is formed and a current of electricity capable of doing work is created. This corresponds to the energy function of the living.

In other words, the physical energy in the living and in the non living is essentially the same. In one case the energy is static, in the other it is dynamic. In the one the difference of potential is produced by means without the mechanism. In the other the difference is constantly maintained by automatic action within the mechanism itself.

#### THE BIPOLARISM OF THE MULTICELLULAR ORGANISM

As we have shown the single cell whether it exists independently as a unicellular organism or as one of the cells of the multicellular organism is a bipolar mechanism the nucleus being the positive element the cytoplasm the negative element.

As the nucleus and cytoplasm of the unicellular organs are evolved respectively into an association of trillions of cells, this primary relation between the nucleus and cytoplasm is presumably maintained among these trillions of cells some groups of which may be considered as nuclear cells because in them is found the highest oxidative capacity while others because of their comparatively low oxidative capacity may be considered as "cytoplasmic" cells. If our conception be true then among the positive or nuclear tissues there must be a tissue of the highest potential of all and since oxidation determines potential we are justified on the basis of experimental researches in considering that the brain is the positive pole in the organism. It remains to give the evidence on which we base our assumption that among the "cytoplasmic"

or negative tissues the liver has the lowest potential—is the negative pole of the organism.

If the brain and the liver are the positive and the negative poles of the organism, then certain conditions would follow from this interrelationship.

1. The brain and the liver would work together would together show specific changes as the result of work would together be restored by sleep. This condition has been proved to exist by histological and by physical researches.

2. If the negative pole the liver were removed, then the unit cells of the positive pole the brain would lose their own potential and the brain would cease to function. This has been proved.

3. Since in their positive-negative relationship the functions of the brain and the liver are antithetic, we would expect that their electric conductivity would vary in opposite directions and that the temperature changes due to stimulation would vary in opposite directions. Both of these expectations have been realized as has been shown by the findings covering experimental researches elsewhere reported.

4. It is the negative pole that accumulates waste acid by products and keeps the circuit clear. This is a specific function of the liver.

From these premises we assume that when the great circuit between the liver and the brain is broken the lipid membranes, the interfacial surfaces between the colloids, the interfaces in the proteins, etc. no longer receive the electrical charges on which their structure and function depend, and coagulation and death follow. Coagulation follows because the infinitesimal particles making up the colloids are no longer held apart by electrical charges. Although as we believe the specific activities of muscles, glands, etc., are carried on by minor circuit nevertheless except the grand circuit between the brain and the liver be kept intact and active life cannot continue. The body as a whole is wired up in innumerable circuits, the unit of which is the nerve cell and its projected nerve fiber.

### THE CIRCUIT IN THE ELECTRO-CHEMICAL MECHANISM

As we have already stated within the unit cells the processes of charging and of discharging follow each other in rapid succession so that an interrupted current passes between the nucleus and the cytoplasm. Thus in each of the unit cells of the brain each cell would fire its charge in a rapid volley through the semi-permeable membranes, the sequence being first an increase in voltage then a break through the film a fall in voltage and an instantaneous rise in voltage at infinitesimal intervals just as is the case in similar apparatus made by man.

Since the membranes of certain cells of the brain are prolonged into highly conductive intercommunicating axons the sum of the charges of many cells may be conducted through their axons past the synapses to the muscles or glands to be stimulated. Through the semi-permeable membranes, however a part of the current may presumably leak through, and a part of the current may not be consumed in the adaptive response of the muscle or gland. This portion of the current, obeying the universal law which governs the flow from the highest to that of lowest potential, would finally reach the point of lowest potential, the liver and from thence be conducted back to the brain by means of the electrolytic fluids permeating the organism. The path from the muscles glands etc. to the liver may well be over the sympathetic nerves everywhere present in the walls of the blood vessels.

The initiation of the energy transforming impulse in the brain and other nerve cells is due to physical forces in the internal and the external environment, that is, chemical impulses in the internal environment and in the external environment, the physical impulses of light, heat contact, and sound waves. These impulses from within or from without initiate the current which passes over one or another portion of a circuit which includes about twenty-eight trillion electro-chemical units, most of which are self-charging condensers, charged up ready to be discharged by a trigger action, on the arrival of the electric impulse initiated in the circuit by the environmental

stimuli. For example, a pattern of white light altered by an object falls on the rods and cones of the eye which is continuously and in even balance responding to white light. This disturbed balance becomes the adequate stimulus which by a trigger action discharges into the circuit millions of charged condensers. We may suppose that from condenser to condenser a vast accumulating electric charge passes down through the interrupting synapses driving muscles and glands to action with consequences which may be commonplace or dramatic. The audition in the wireless, the stepping up mechanism of the long distance telephone are but weak imitations of the marvelous augmentation and step-up mechanism which probably operates in the human brain.

Electricity it would appear is the thread which binds together in form and function the compound the solution the colloid the cell the animal.

### A THEORETICAL LINE OF DESCENT FROM THE ATOM TO MAN

Have the living cell and the atom a similar physical pattern of structure and a similar arrangement of their physical forces in each is the internal stress as well as the internal balance similarly staged? Is it possible to identify a law which governs alike inorganic and organic evolution and points the line of descent from the atom to man?

An evenly balanced atom such as helium between whose positive nucleus and two negative electrons there is no unbalance would go on through all time in complete neutrality neither giving nor receiving energy. But a highly unbalanced atom like hydrogen with its highly positive nucleus only partially balanced or satisfied by its single negative electron, is vigorously attracted to negative atoms. In the hydrogen atom there is a difference in potential in a bipolar unit of the smallest dimensions. This potential energy unbalance and this form of bipolarity is probably identical with the unbalance which is the basic condition of life but it is not life as we know it perhaps the principal reason being that this bipolar mechanism—the hydrogen atom—is so far beyond the range of our



senses. But if we could place millions of these infinitesimal particles of positive electricity on one side of an exceedingly thin film of ray  $4/10,000,000$  of a centimeter thick, with negative charges on the opposite side and if we could adaptively charge and discharge these films in work and function, then in the aggregate we would find the hydrogen atom an essential part of a living organism. A single brick is not a building but millions of bricks with other material may be arranged into many buildings so a single hydrogen atom is not a living being, but millions of hydrogen atoms with other elements may be arranged into living beings.

It may be supposed that it is the disturbance in the carbon atom caused by the sun's energy that endows the carbon atom with the energy which in combination with hydrogen it carries with it into the cells of animals where it is released in the electric process of oxidation. Thus, energy available for building living beings or for the use of living beings comes from the sun. Chemical action is identical with electric action, for it is the attraction and the repulsion of unbalanced negative and positive elements that makes compounds, solutions, colloids. If there were no atomic no intermolecular no interfacial electric phenomena there would be no compounds, no solutions, no colloids, no life.

The atom, the compound, the solution, the colloid contain as much energy outside the living cell as within the cell the difference being that in their existence as separate entities the electric energy is balanced and since no difference in potential is established there is no free energy such as is seen in and is characteristic of the living. In addition to the interatomic, intermolecular interfacial forces, living organisms require free energy between positive and negative poles which are separated from each other by a sufficient distance so that the current flowing between the poles may release a continuous stream of new energy to perform work. This energy when governed by the environmental forces becomes available for the various forms of work and function needed for survival. A bipolar mechanism with films adapted to receive charges of electricity and to release electricity for the oxidation

tion required to meet the needs of survival is a living thing.

It is not necessary that the negative or cytoplasmic part of the cell should be continuous or that it should be bound only to one nucleus. For example Kofoid and others have shown that in certain unicellular organisms there may be one continuous cytoplasm with many nuclei of varying size and shape. This is a crucial point in a consideration of the descent of living matter for on this basis we can see how an infinite amount of negative colloids forming the fertile part of the earth—in sea water mud, soil—might be looked upon as a vast negative area or cytoplasm and infinite masses of positive colloids, each surrounded by thin films with a high oxidative capacity might well be considered as positive nuclei.

These positive nuclei we may regard as bacteria. A bacterium might thus be regarded as a first "step-up" from the uniform colloid occupying together with millions of other like positive nuclei (bacteria) a common cytoplasm—seawater soil, mud, etc. If this conception were correct, then we would expect to find that bacteria (nuclei) would stain like the nuclei of cells and so they do. Since bacteria (nuclei) depend for their existence on a difference in potential between them and their cytoplasm, we would expect to find that bacteria are sensitive to the hydrogen ion concentration of the media and this is so. For the same reason we would not expect that bacteria could successfully compete for energy—life—with the nuclei of cells. Bacteria are rarely found in the nuclei of cells. Bacteria, then, in terms of physics are multiple positive nuclei occupying in common a continuous negative cytoplasm.

By a fortuitous circumstance a bacterium, surrounded by a wider secondary film, might at some moment have acquired for itself some of the cytoplasm or negative colloid which it had shared with all the other bacteria and so it would have become independent of the common supply of negative colloids or cytoplasm and would have become the first independent electro-chemical mechanism, both of whose poles were separated from the common surroundings that is, it would have become a cell.

Thus, according to our theory living cells are self-charging condensers built on the fundamental pattern of the atom, and animals in turn are developed into the larger more complicated forms by progressive additions of these electro-chemical units

#### AN ELECTRO-CHEMICAL INTERPRETATION OF NORMAL AND PATHOLOGICAL PHENOMENA

If the electro-chemical theory is correct, then it must interpret the abnormal as well as the normal phenomena of animals and man. Thus, it must interpret in electro-chemical terms such major phenomena as the emotions physical exertion etc. It must interpret the effect of physical and chemical injury the effect of want of oxygen of want of water the effect of too much, no less than that of too little heat, the defense against bacteria the process of healing of wounds the effects of anesthetics, and of the various drugs the phenomena of hyperthyroidism and of thyroid deficiency the phenomena of excessive adrenal activity and of adrenal insufficiency

It must interpret the difference in physical mechanism between a fertilized and a non-fertilized cell between a cancer and a normal cell it must show the mechanism of stimulation and of depression it must interpret shock, exhaustion and death it must interpret sleep and restoration. While all of these interpretations have not been made as yet, the data thus far accumulated present such uniformly supporting evidence that we believe that the basic evidence whereby to interpret most if not all of the phenomena of life will ultimately be secured

Since electric conductivity and the production of heat are basic phenomena in the operation of an electro-chemical mechanism we have tested the theory by measurements of changes in electric conductivity and of heat production in various organs and parts of the body in accordance with the electro-chemical theory we would expect

- 1 That the electric conductivity of cells would vary with stimulation and depression
- 2 That the conductivity of the part of highest potential (the brain) and the conductivity of the part of lowest potential (the liver) would vary in opposite directions

3 That physical or emotional excitation excitation produced by the intravenous injection of adrenalin, by physiologic doses of iodine, or of thyroid extract, or the injection of strychnine would show in the brain an increased conductivity in the stage of excitation and a diminished conductivity in the stage of fatigue and anesthetic effects in the liver

4 That ether anesthesia in its early or excitant stage would show an increased conductivity, and in the depressant or anesthetic stage a diminished conductivity of the brain

5 That morphine would minimize or prevent changes in electric conductivity as the result of adrenalin of infection of physical injury of emotional excitation.

6 That the excision of the liver or of the adrenals would decrease the conductivity of the brain.

7 That prolonged consciousness carried to the state of fatigue would decrease the conductivity of the brain and that sleep would restore the normal conductivity

8 That the actively multiplying cancer cells would show a higher conductivity than the normal cells of the tissue in which they arose that the central autolyzing, non growing part of a cancer would have a lower conductivity than the aggressively growing margin of the cancer that such pre-cancerous tissues as X ray scars, adenomata or fibroid tumors would have a conductivity higher than normal.

9. That such mediating fluids as blood cerebrospinal fluid and bile would have a high conductivity

All of these expectations have been realized by the test of electric conductivity measurements.

Having found that the changes in electric conductivity were consistent with the electro-chemical theory we then by means of accurate and sensitive thermocouples made simultaneous observations of the temperature changes in the various organs and tissues that might be concerned in energy transformation under the same normal and pathologic conditions as those studied in the foregoing conductivity experiments.

Since according to our theory oxidation is the source of the difference in potential and

since heat is a constant by-product of oxidation, we would expect to find that the temperature of the brain would be increased by stimulants and decreased by depressants.

We would expect to find that stimulation would produce opposite effects upon the temperature of the brain and of the liver and other relatively negative organs. Upon testing these assumptions we found that the temperature of the brain was increased and that of the liver and other negative organs was decreased or unchanged in the acute stage of stimulation by emotion by physical injury by strychnine injection, by the injection of adrenalin when the output of adrenalin was artificially increased by asphyxia in the excitant stage of ether anesthesia.

On the other hand, if we were correct in our assumption that the liver is the center of negativity and is essential to keeping the circuit in the bipolar mechanism free from chemical by-products, then if the liver were removed we would expect that the circuit in the bipolar mechanism would become progressively interfered with and would finally be completely blocked with the resultant establishment of equilibrium or death. We found by experiment that when the great circuit which energizes the organism was broken by the removal of the negative pole the liver the temperature of the brain steadily fell until death occurred also that when stimulants such as adrenalin were given, heat production (oxidation) within the brain bereft of its negative pole was almost or entirely prevented.

Again, in accordance with the bipolar theory we would expect to find a steady fall in the temperature of the brain when the semi permeable films around the cells, the charges upon which govern oxidation were rendered less permeable. We found that in the state of deep ether anesthesia which lessens the permeability of these films and hence interferes with oxidation the temperature of the brain and of the liver fell steadily until death occurred.

On the other hand we found that in nitrous oxide anesthesia which interferes with oxidation itself but does not interfere with the permeability of the lipid films surrounding

the cells, the temperature of the brain decreased much more slowly.

We found also that sodium which increases permeability and calcium which decreases permeability having opposite physical effects had opposite effects on the temperature of the brain which was increased by sodium, and decreased by calcium.

We expected to find that in strychnine convulsions we would see violent changes in the temperature of the brain and the liver and our expectation was realized.

Since morphine stabilizes the organism since one of the clinical effects of morphine is the elimination of emotion and since the emotions probably excite the adrenals to increased activity (Cannon) we expected to find that if an animal were first deeply narcotized with morphine, then given adrenalin, the morphine would interfere with the great change in the temperature of the brain which is produced by adrenalin in normal animals and our expectation was realized.

Since certain lethal agencies such as the cyanides produce a phase of excitation followed by depression we expected to find a brief temperature rise followed by a dramatic fall and our expectation was realized.

Since the intravenous injection of adrenalin causes increased oxidation, and since asphyxia causes an increased output of adrenalin, then if an animal were asphyxiated we expected that the consequent increase in the output of adrenalin would increase the temperature of the brain and our expectation was realized.

On the other hand if both adrenal glands were first removed, then asphyxia could produce no increase in adrenalin and in consequence we expected that in an adrenalectomized animal asphyxia would not cause any increase in the temperature of the brain and our expectation was realized.

The first effect of a lively hemorrhage is to call out an emergency increase in adrenalin (Cannon). We therefore expected that in an acute hemorrhage the temperature of the brain would show a temporary rise and our expectation was realized.

These observations on so fundamental a group of facts as the expected variations in temperature and electric conductivity run

parallel with another great group of observations which are just as fundamental but have a much larger chance of error. I refer to the microscopic changes in the size and in the differential stainability of the cells of the leading organs of the body in excitation and fatigue. These carefully studied changes in the cells suggested the electro-chemical theory. In these experiments we found that vital function varied with the differential stainability of the cells of the brain and of the liver and to a lesser degree of the cells of the adrenal cortex. If the acid alkali stain of the nucleus and of the cytoplasm respectively is a measure of the respective intensities of the acid or nuclear part and of the alkaline or cytoplasmic part and if the energy of the organism is dependent on the difference in potential and the difference in potential is due to the relative acidity and alkalinity then the cytologic studies by Dr Austin, Dr Hitchings and myself are strongly corroborative of the electro-chemical or bipolar theory.

#### A SUGGESTION AS TO THE ELECTRO-CHEMICAL BASIS OF REPRODUCTION

It is a universal law of nature first stated by Cohnheim that cells alone can produce cells. If oxidation in the cells is due to the electric potential and if oxidation and the film condenser are essential to life then we can see that the potential can be handed on only by a division of the cell the division of the cell including a division of the mechanism which creates the potential in such a way as to provide in each new cell a difference in potential i.e. the flame of life must be handed on from cell to cell. Thus, we may conceive that when the spermatozoon which is essentially a nuclear structure is added to the nucleus of the ovum a greatly augmented nucleus is formed with a corresponding increase in oxidative capacity hence a capacity for attracting and using food increasing in size and in consequence multiplying by cell division.

#### AN ELECTRO-CHEMICAL CONCEPTION OF THE DEVELOPMENT OF CANCER

By analogy we may conceive that the facilitation of cell division in cancer in some way

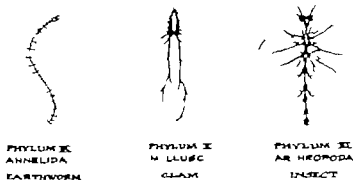
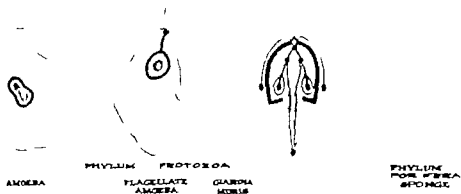
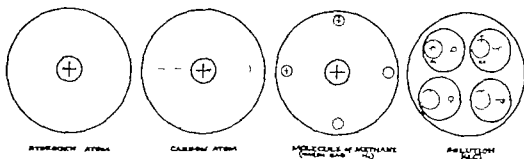
as yet unknown depends upon an addition to the oxidative or nuclear part of the cell. Such an increase in oxidative capacity would add to the bulk of the cell just as the increase of oxidative capacity in fertilization increases the size of the ovum. By the division of both the nucleus and the cytoplasm the relatively high electric potential would be handed on to the daughter cells, in which in turn the potential would be correspondingly high and thus the process would become progressive at the expense of the cytoplasm of the neighboring cells. Thus in the case of a group of cells which have been injured by repeated slight trauma, or by irritation of any kind so that the cells are alternately injured and repaired we may suppose that one cell may have become fused with another or that by some other means the oxidative capacity of the nucleus has been increased with a resultant increased size of the nucleus and hence increased potential. This cell would then multiply at the expense of its neighbors and a cancer would develop.

#### THE ELECTRO-CHEMICAL ROLE OF SLEEP

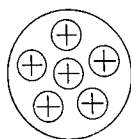
If a battery is made to work continuously by keeping its circuit closed polarization of the plates will take place and the battery is said to be exhausted which means that the difference of potential has diminished or disappeared. It would appear to be more than a mere analogy that prolonged consciousness unbroken by sleep leads to exhaustion and death.

If the period of work—i.e. if the passage of electric current is short, as in a single heart beat then the degree of polarization is *proportionately small*. The small degree of polarization which results from a single heart-beat requires a proportionately short time for repolarization or sleep—i.e. the pause in the heart cycle may be regarded as its period of sleep. The heart with its nerve mechanism takes normally from seventy to ninety naps a minute and thus is kept polarized or rested as it works.

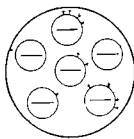
We may suppose that the nerve cells which operate the respiratory mechanism become polarized or sleep, from sixteen to eighteen times per minute and that thus the respira-



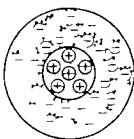
This is showing theoretical descent from one to another, the red showing the power (nucleus) elements, the blue, the organs (cytoplasmic) elements.



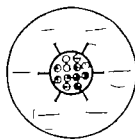
POSITIVE COLLOID



NEGATIVE COLLOID



AMOEBA



HYDRA ANIMALS



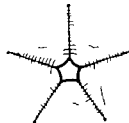
PHYLUM I  
COELENTERATA  
SEA ANEMONE



PHYLUM II  
HELMINTHES  
TEREBRATULID



PHYLUM II  
MOLLUSCA  
POLYZOON



PHYLUM III  
ECHINODERMATA  
STAR FISH



SUBPHYLUM  
TUNICATA  
ASCIDIAN  
(LAMP)



SUBPHYLUM C  
CEPHALOPODA  
AMPHIOLUS



CLASS I  
LAMPBRUSH  
ELECTRIC FISH



SUBPHYLUM D  
VERTEBRATA  
CLASS II  
AMPHIBIA  
SALAMANDER

CLASS III  
MAMMALIA  
MAN

PHYLUM XII - CHORDATA

Diagram showing theoretical descent from atom to man, the red showing the protoplasmic (nuclear) elements, the blue the organic (cytoplasmic) elements.

tory mechanism is kept polarized or rested as it operates.

The salivary glands, the intestinal nerve-muscle mechanism, the digestive glands, etc. we may suppose have alternating periods of *work and polarization* and of *sleep and re-polarization*. Regarded superficially the functions of respiration or circulation or digestion carry on as if they never rested, never slept but their sum total of short periods of sleep is quite as large as the total period of sleep of that part of the brain whose work creates consciousness, and therefore spends no more time in sleep but sleeps more conspicuously.

As for the portion of the brain which governs conscious activity the periods of work, and therefore of polarization of the cell that supply the electric power for consciousness, for emotion and for muscular action are longer than the periods of work demanded by the heart, by the respiratory mechanism or by the digestive mechanism. Thus the option of evolution apparently has been to run the organism on long shifts or shorter ones.

If the changes in the nerve cells seen in fatigue from various kinds of work and from prolonged enforced consciousness are identical in appearance. If these physical changes are restored only during sleep and if the degree of cell change varies with the amount of work done at a stretch without sleep, that is with the amount of electric energy that has originated in or traversed a given cell, then it would require more time and deeper sleep to restore the electrical balance of the cell after prolonged heavy muscular exertion than after a day of restful quiet. And this is demonstrated by experience. It would appear that the degree of exhaustion equals the protraction of consciousness multiplied by its intensity.

Sleep, being a negative phase, cannot be *compelled*. Consciousness, being a positive phase can be *compelled*—even unto death. Normal man cannot sleep unto death; he can sleep only to restoration—no more.

#### THE RELATIONSHIP OF THE ELECTRO-CHEMICAL THEORY TO SURGICAL MORTALITY

If the electro-chemical theory is correct then it must stand the crucial test of the clinic not only in the interpretation of pathological

processes but also in the indication of methods of conservation and restoration. If the operation of the organism can be interpreted by the laws of physics, then methods for the protection and restoration of the organism should be dictated by the same laws. For the optimum operation of the electro-chemical organism the maintenance of an optimum difference of potential the following conditions are essential:

1. An abundant supply of water.
2. An abundant supply of oxygen delivered to the cells.
3. Maintenance of the semi-permeability of the lipid cell membranes.
4. Maintenance of an optimum temperature.
5. Maintenance of the integrity of the poles of the organism, that is of the cells in the brain and the liver.
6. Sufficiently long and sufficiently frequent periods of sleep.

The practical application of these principles in the treatment of the "bad risk" patient may be briefly outlined as follows:

1. Water is given in abundance by every route, 2,000 to 4,000 cubic centimeters or more given by hypodermoclysis most quickly reaches the cells.

2. Oxidation is promoted by the maintenance of an adequate circulation by transfusion. If the volume is below normal and by digitalization to strengthen the myocardium if the minute volume is diminished by a weakened myocardium.

3. The semi-permeability of the cell membranes is conserved by the avoidance of ether anesthesia and the employment of nitrous oxide-oxygen analgesia—*not anesthesia*—plus local anesthesia.

4. An optimum temperature is secured by the obvious measures indicated by the needs of the individual case. Of peculiar value are large hot packs over exposed abdominal viscera. The administration of hot fluids by mouth not only supplies local heat and water but as experiments have shown its effects are instantly manifested by increased oxidation in the brain.

5. The integrity of the brain and the liver is kept from further damage by environ-

## CONCLUSIONS

mental control by the infliction of minimum trauma by performing the operation in the patient's room and above all by securing adequate sleep and rest. The protective effect of morphine in particular is needed and when that is contra indicated other narcotics and sedatives should be utilized to promote the needed periods of repolarization. The necessity is the maintenance of a difference in potential—this is the maintenance of life.

Just as no two man-made electric mechanisms require exactly the same combination of methods for repair so the treatment of the human electric mechanism must be individualized and since we desire to conserve as well as restore, these measures should be employed in advance of the emergency.

Since the initiation of this plan of treatment formulated in accordance with physical laws, our surgical mortality and our surgical morbidity have been progressively decreased. In 14,949 operations performed at Lakeside Hospital during the last three and one half years the surgical mortality has been 1.8 per cent in all operations performed during 1922 the mortality was 1.6 per cent. In operations for acute abdominal conditions—gastro-enterostomy and resection of the stomach, cholecystectomy and cholecystostomy, colostomy and resection of the large intestine and operations for acute appendicitis, the mortality has been 3.8 per cent. In this group are included 141 operations for cancer of the large intestine including 51 resections, with a mortality of 2.8 per cent.

Perhaps in no other group of cases has the validity of the biophysical interpretation of physiological processes been more strikingly demonstrated than in the results of operations on the thyroid gland. Thus, in our last 500 thyroidectomies there has been a mortality of 0.6 per cent. In our last 500 ligations there has been a mortality of 0.4 per cent and in our last 720 operations upon patients with hyperthyroidism in whom the condition was so acute that the operation was performed in the patient's room, the mortality has been 1.2 per cent. In the last 1,000 thyroidectomies for hyperthyroidism performed in the operating room as well as in the patient's room the mortality has been 0.8 per cent.

Although the electro-chemical theory interprets well the normal and the pathological phenomena of man and animals although the numerous predictions based upon this theory were established by the more exact methods of physics although it has furnished a plausible suggestion as to the line of evolution from the atom to man although the theory has stood the crucial test of the surgical clinic by providing a scheme of management which has produced the shockless operation—the theory is not yet proven, and will not be proven until the equivalent of a living cell is constructed until the equivalent of life is artificially made.

Nevertheless, from previously accepted facts, from clinical observations and from the evidence of experimental researches in our laboratory of biophysics we conclude —

1 That electric phenomena are co-existent with living phenomena because electricity is detected in every living plant or animal and is absent in the dead

2 That electricity is manifested in every act of the living and is probably the so-called "spark of life"

3 That there are great numbers of different kinds of electric circuits in animals

4. That the source of electricity in the cells is oxidation

5 That oxidation in the cells of the organism is initiated and governed by electricity

6. That electricity is accumulated on the lipid films of the trillions of cells

7 That each of the trillions of cells is a diminutive electro-chemical unit

8. That during life there is a difference of potential a state of unbalance within the organism

9 That death is equilibrium of potential

10 That there is a universal pattern of the living in the form of bipolarism

11 That in the non-living no less than the living exists the universal pattern of bipolarism

12 That the pattern of bipolarism runs in continuity from atom to man

13 That man is an electro-chemical mechanism, a giant amoeba climbing up the slippery banks of time



CHRONIC DUODENAL STENOSIS<sup>1</sup>

BY JAMES MCKENRY, M.D., F.A.C.S., WHEATRIA, CALIF. ADA

Papers 31, *Boulevard Hospital*

CHRONIC partial stenosis of the duodenum may be due to a number of causes. This paper is limited to a consideration of the form resulting from compression of the bowel between the root of the mesentery (with its contained superior mesenteric artery) and the aorta.

The clinical significance of the anatomical relations of this part of the duodenum was first brought to the attention of the profession generally through the study of the etiology of acute dilatation of the stomach during the last decade of the nineteenth century. That compression by the root of the mesentery is an important perhaps the most important factor in the causation of this acute condition is now widely accepted. Its relation however to the chronic form of duodenal dilatation has only recently attracted attention and needs further study.

Since January 1914 when my attention was first directed to the subject I have examined the duodenum and the root of the mesentery in all clean laparotomies in which the position of the incision permitted and the condition of the patient justified the additional exploration. During these 8 years there was discovered in 26 cases evidence of some degree of obstruction by the root of the mesentery. The operative findings on which this diagnosis was based in these cases were as follows:

1. Dilatation of the duodenum throughout its whole length from the pyloric ring to the point where it is crossed by the superior mesenteric artery. This is readily observed in the supracolic portion which may be so dilated as to lie in contact with the anterior abdominal wall. By drawing up the transverse colon the third portion of the duodenum may be seen and felt bulging through the lower layer of the transverse mesocolon.

2. Narrowing of the angle between the superior mesenteric artery and the aorta sufficient to obliterate the lumen of the bowel at this point. This is determined by inserting the tip of the index finger from left to right

into the angle. A fairly accurate estimation of the size of the angle can thus be made.

3. On elevating the root of the mesentery by the finger the gas within the duodenum is seen to pass on into the jejunum which was previously collapsed.

4. Palpation of the duodenal wall gave the impression in a few cases of hypertrophy of its musculature.

The degree of dilatation is indicated in my records by the plus sign. Of the 26 cases eleven are marked + seven ++ and eight ++++. None were classed +++++. The duodenum in the eight marked ++++ was a little greater in diameter than the dilated transverse colon. With one exception the only cause of the apparent obstruction was compression by the root of the mesentery. In this one case there was in addition, adhesions between the gall bladder and the descending portion of the duodenum.

The finding of a duodenum not dilated but distended with gas which is evidently prevented from passing on into the empty jejunum by compression of the root of the mesentery has been, in my experience much more frequent than the finding of actual dilatation of the bowel. This temporary stasis may be attributed to narrowing of the vascular angle by the dorsal position on the operating table and to suppression of peristalsis by the pre-operative dose of morphine. A continuation of the dorsal position and the morphine after operation, I believe may be responsible for many cases of acute postoperative dilatation of the stomach.

## ANATOMY

In man as shown by the studies of Dwight and others, the bowel as it lies behind the root of the mesentery is not a cylindrical organ but is flattened to the ovoid form (Fig. 1). In the domestic animals, on the other hand, as may be seen by a visit to an abattoir, this vascular angle is wide and, the bowel being free from compression, retains the cylindrical form. It may be noted, also that in all the

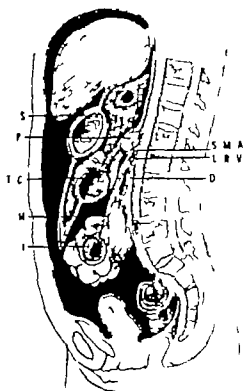


Fig. 1. Transverse section of the normal duodenum. (Modified from Gray's Anatomy) s, Stomach; p, pancreas; t, transverse colon; m, mesentery; sma, superior mesenteric artery; lr v, left renal vein; d, duodenum.

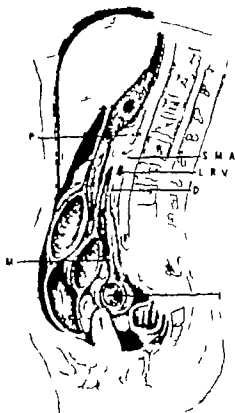


Fig. 2. Drawing showing compression of the duodenum in the enteroptotic female. p, Pancreas; m, mesentery; t, ileum; sma, superior mesenteric artery; lr v, left renal vein; d, duodenum.

well-known quadrupeds the anteroposterior diameter of the body in its middle zone is greater than the transverse diameter while in the human, the transverse diameter is the greater and, in individuals of the enteroptotic figure, the disparity between these diameters is usually most marked. It is evident that the greater the divergence from the form of body seen in quadrupeds the greater will be the acuity of the vascular angle, and the more marked the flattening of the duodenum. In the virginal type of enteroptosis the superior mesenteric artery may be found in its upper portion, lying very close to the aorta (Fig. 3). The anatomical relations of the structures in this region suit the postures assumed by the lower animals but are not well adapted to either the erect or dorsal postures assumed only by the human. Duodenal compression

by the root of the mesentery occurs only in the human, and is clearly one of the many disabilities resulting from the assumption of the erect posture. It is evident also that the habit, still prevalent of keeping the patient on the back for from 24 to 48 hours after operation, without special reason, is likely to lead occasionally to trouble. The normal individual never voluntarily maintains the dorsal for more than a few hours.

It is a reasonable inference that individuals presenting the above laparotomy findings have, while in the erect or dorsal position, a duodenal outlet so compressed as to amount to a chronic partial obstruction. To overcome this obstruction undue peristaltic effort is required resulting, at first, in compensatory

hypertrophy of the musculature, followed later when this fails by dilatation of the duodenum. The "writhing duodenum" described by roentgenologists and the increased thickness of the duodenal wall noted in some of my cases support this view.

The frequent association of visceral ptosis with arterio-mesenteric obstruction has been noted in most of the papers published upon this subject. In 19 of my 26 cases, ptosis of the cecum and right half of the colon was present. Of the 7 remaining cases, which were free from visceral ptosis, two had adhesions of the ileum to structures in the pelvis. In 5 nothing was found to account for the evident drag upon the root of the mesentery. Dilatation of the stomach with a wide-open pylorus was present in nearly half but gastropnoia without dilatation, is recorded as occurring once only in these 26 cases. On the other hand in 5 cases of extreme prolapse of the stomach, occurring in individuals with the virginal type of visceral ptosis, laparotomy disclosed a normal duodenum in every case. My experience, therefore, supports the view that, at most, gastropnoia is only a minor factor and that a loose cecum with an elongated parieto-colic fold getting its support from the mesentery of the small bowel is the most important cause of mesenteric compression of the duodenum.

The functions of the duodenum are only imperfectly known. It has been amply established however both experimentally and clinically that complete obstruction to the onward flow of its contents leads to a rapidly fatal issue with symptoms of profound toxemia. That chronic partial obstruction may also result in the formation of the toxic substance, or reflexly interfere with functions of liver and pancreas with symptoms of chronic toxemia, seems highly probable.

#### DIAGNOSIS

Chronic duodenal obstruction must be added to the list of conditions underlying chronic dyspepsia, once regarded as 'the prevailing malady of civilized life'. The dyspepsia associated with it presents no distinctive features and a definite diagnosis from the clinical history alone cannot be made.

Symptoms of a chronic toxemia, particularly headaches relieved by vomiting of bile the so-called bilious attacks, when occurring in individuals the subjects of visceroptosis, are most significant. Chronic disease of appendix or gall bladder was the pre-operative diagnosis in the majority of my cases, and usually disease of these structures was found along with duodenal dilatation. Indeed, the presence of chronic multiple abdominal lesions is the rule in the type of individual subject to mesenteric occlusion of the duodenum. Another significant feature is the relief from gas and the feeling of distention afforded by assuming the latero-prone position after meals, especially if this is preceded by the knee-chest position for a few minutes. I have found palpation and percussion of little help in trying to detect a distended duodenum. Roentgenological examination is the most important diagnostic means, and in the hands of an expert will definitely determine whether or not duodenal stasis is present.

#### TREATMENT

1. *Non-operative treatment* consists in the use of corsets and abdominal belts designed to support the prolapsed viscera. This always affords a measure of relief. In the acquired type of visceral ptosis the relief is usually complete so long as the support continues efficient. It is well known that pregnancy relieves the symptoms of visceral ptosis. In 1909 during operation for appendicitis upon a young woman her duodenum was observed to be dilated. She had the enteroptotic figure in marked degree and since puberty had been subject to digestive disturbances with periodical "bilious spells". These symptoms were not relieved by the removal of the diseased appendix (no other operation was done) and very slightly by the use of a well fitting corset. She married and during the latter half of each of her five pregnancies she has been quite free from symptoms but during the intervals between pregnancies suffered as before. X-ray examination 1920 showed duodenal stasis present in marked degree. In such cases (and they are not uncommon) is the relief due solely to the support afforded by the pregnant uterus, or is a change in the internal secre-

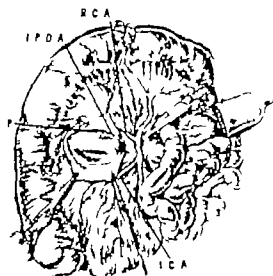


Fig 3 The duodenum is exposed between the right colic and ileocolic arteries c Right colic artery ileocolic artery p, pancreas p d inferior pancreaticoduodenal artery

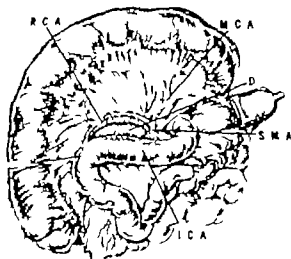


Fig 4 An additional stitch is placed to prevent angulation c Right colic artery ileocolic artery m c middle colic artery d, dilated duodenum, s m a superior mesenteric artery

tions also a factor? As the relief does not come until the uterus is large enough to fill the pelvis, the mechanical factor seems to be if not the only one at least the most important

**Posture** Inasmuch as chronic cases are rarely confined to bed, postural treatment has a limited application. It is especially useful in the prevention of postoperative acute dilatation. The patient with the above operative findings should be early changed from dorsal to lateral position, even at the cost of temporarily increasing his discomfort. The incidence of acute dilatation of the stomach will thereby be decreased. In carrying out the rest cure in individuals, with this type of body form, the possible injurious effect of the prolonged dorsal posture should be remembered.

**2 Operative treatment** a Gastro-enterotomy was the first operation tried for the cure of duodenal obstruction. The results in the considerable number of cases now recorded have with few exceptions, been quite unsatisfactory. In those cases in which the pyloric ring is dilated and incompetent permitting duodenal contents to regurgitate into the stomach, some benefit will accrue. In important papers recently published, Hartmann (2) Wilkie (3) and the Kelloggs (4) ex-

press the view that the operation is unsuitable and that the indications are best met by anastomosis between duodenum and jejunum below the transverse colon.

b Duodenojejunostomy was first suggested by Professor Barker (5) in discussing a paper read by Dr Finney on duodenal obstruction at a meeting of the Johns Hopkins Medical Society in November 1905 and it was first performed by Dr A. W. Staveland in December 1907 (6). There is no record in the literature of Staveland's operation having been again resorted to until it was performed by the writer (7) in January 1914. Now there are more than sixty published cases, most of them reported during the past 3 years. This indicates how recent is the interest in the subject. The Kelloggs report 41 duodenojejunostomies 30 of which were done for this form of duodenal obstruction (8).

In 13 of my 26 cases this operation was performed, the last one January 1922 and the first one 8 years previously. An analysis of these 13 cases is given in the accompanying table. In all except one (Case 10) other operations were also performed at the same time.

There was one operative fatality. In case 9 death was caused by intestinal obstruction from angulation at site of anastomosis. A

## ANALYSIS OF 13 CASES IN WHICH DUODENOJEJUNOSTOMY WAS PERFORMED

Case	Sex	Age	Clinical diagnosis	Bile-stools	Vomiting	Operative findings	Duodenal dilatation	Operation performed in addition to duodenojejunostomy	End result
	F	31	Dilated ulcer	+++		Chronic appendicitis	+++	Appendectomy	Well till Dec., some 6 years after operation, then got bilious symptoms
	F	13	Chronic appendicitis		++	Chronic appendicitis	++	Appendectomy	Well for years and of p.h. 54 years after operation
	M	17	Chronic appendicitis	+++	++	Chronic appendicitis	++	Appendectomy	Well 6 mos. after operation unable to trace place then
	F	5	Duodenal stasis		+++	Chronic appendicitis, caecum lying upon the bladder	+++	Appendectomy, Cholecystectomy	Well now 5 years since operation
	M	30	Chronic appendicitis, dilated at onset		++	Adherent appendix	+++	Appendectomy	Well
	F	17	Cholecystitis, duodenal stasis, floating kidney	+++	+++	Chronic appendicitis and cholecystitis, right colonocele	+++	Appendectomy, Cholecystectomy, nephrectomy	Much improved, but still has bilious stools
	F	29	Chronic appendicitis		++	Adherent appendix, tubercle caecum	++	Appendectomy	Well
	M	29	Duodenal stasis, dilated stomach		+++	Stomach 4 in. distended, pyloric ring dilated, caecum prolapsed, appendix inflamed	++	Appendectomy, gastropexy (Keyes)	Well
	F	20	Gall bladder infection			Gall bladder adherent to duodenum, empyema	++	Cholecystectomy, resection of lower part of duodenum	Died on 24th day from shock due to gangrene at site of anastomosis
	F	14	Chronic cholecystitis	+++	++	Gall bladder and appendix inflamed, stomach and duodenum dilated	++	None	Great improvement in 6 months' symptoms
	F	11	Chronic appendicitis	++	+++	Adherent appendix, stomach dilated and prolapsed caecum mobile	+++	Appendectomy	In better health than for 10 years—gain in weight 112 lb. to 95
	F	29	Chronic cholecystitis and chronic appendicitis	+++		Appendix adherent and (inflamed) gall bladder adherent, contracted stomach	+++	Appendectomy	Much improved
	M	29	Chronic appendicitis, chronic cholecystitis		+	Appendix adherent, gall bladder enlarged, stomach dilated	++	Appendectomy	Well

cholecystectomy and a herniotomy were done at the same time, but the fatality was due to a complication of the duodenojejunostomy and must be debited against this operation. All cases reported to date have recovered from operation.

The end-results of the 13 operative recoveries show 9 cured (one of these died of pulmonary tuberculosis 5½ years after the operation), 2 much improved, and in 1 (Case 10) in which duodenojejunostomy was the only operation performed the result is unsatisfactory.

In doing a duodenojejunostomy the duodenum is exposed between the right colic and ileocolic arteries (Fig. 3). The mobilization

necessary for the application of a clamp can be effected most easily by separating the bowel from below and behind where it is attached by loose areolar tissue to the large vessels and the vertebral column. It is maintained in the intraperitoneal position by suturing the margin of the incised peritoneum to the sides of the exposed segment of bowel. The anastomosis is then made in the usual manner. Since the fatality from angulation occurred, an additional suture has been placed (Fig. 4) designed to prevent this complication.

c. Suspension of the cecum. Bloodgood pointed out that the loaded prolapsed cecum exerts a pull upon the root of the mesentery "when the last portion of the ileum has an

unusually short mesentery. This can be determined during a laparotomy by placing a finger behind the superior mesenteric artery and observing the effect of alternately elevating and depressing the cecum. In some cases the test is not easily made and the result will be in doubt. In 19 of the 26 cases of duodenal dilatation, it is recorded as positive. I have accepted a definitely positive finding as an indication for suspension of the cecum. In 13 of the 26 cases this was the only operation done for the relief of the duodenal obstruction. The end-result has been obtained in only 9 of these. Six are cured and three are no better. The operation performed consisted in reefing the elongated parietocolic fold by linen sutures, suspending but not fixing the bowel

#### CONCLUSIONS

1. The position of the distal portion of the duodenum behind the root of the mesentery is not well suited to either the erect or dorsal posture.

2. As a consequence of compression at this point, duodenal stasis, of degree sufficient to give rise to symptoms, results and constitutes a definite clinicopathological entity of more common occurrence than symptom producing nephroptosis.

3. The drag upon the mesentery of the small intestines by a loose cecum prolapsed into the pelvis is by far the most common cause. This drag can usually be determined at operation by the test described above. It may also result from adhesions of the mesentery to structures in the pelvis. Gastroptosis is probably only a minor factor.

4. Suspension of cecum, ascending colon and hepatic flexure adequately meets the indications and gives satisfactory results in the great majority of cases.

5. Duodenojejunostomy should be restricted to the more extreme cases of dilatation and to those in which the cause of the mesenteric compression cannot be discovered and removed. In my practice, it is being performed much less frequently than formerly as the comparatively minor suspension operation has proven satisfactory.

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## PREMATURE SEPARATION OF NORMALLY IMPLANTED PLACENTA

## A BRIEF REVIEW OF THE LITERATURE AND REPORTS OF SEVERAL ILLUSTRATIVE CASES

By R. A. SCOTT M.D. F.A.C.S. EVANSTON ILLINOIS

*Junior Attending Gynecologist and Obstetrician, Evanston Hospital*

**A**LTHOUGH this rare obstetrical accident was reported as far back as 1603 by a certain Frenchman to Rigby in 1776 is due the credit for the first satisfactory differential diagnosis between antepartum hemorrhage due to placenta previa, and premature separation of the normally implanted placenta. During the years that followed, a large number of men reported cases, all dealing with frank or concealed hemorrhage. This type of hemorrhage is termed by some abruptio placenta uteroplacental apoplexy by Holmes ablatio placenta; and by many premature separation of the normally implanted placenta. The last, I think, is most descriptive

centa measured 14 by 17 centimeters and the cord was 43 centimeters in length. Two coils of the cord were about the child's neck, and held the head close to the lower border of the placenta. The mother's postpartum course was satisfactory.

**CASE 2.** M. Trillat reports Para III 3 1/4 months pregnant. The patient had driven to the village with her husband. On return, 6 hours later she complained of fatigue, started to walk, was taken with hemorrhage, carried home and thence to hospital. On entrance the patient was in coma, the fetal heart was not heard, the cervix was dilated 5 centimeters. At touch, the placenta was not felt. The membranes were ruptured artificially. An incision of the cervix with craniotomy was done. The placenta was entirely free and was removed manually without difficulty. There were no gross changes. The opening of the membranes was made 6 centimeters from the placental border. The uterus was not ruptured. A tampon was used to arrest the hemorrhage. Intravenous and cellular injections were given. The Moberg procedure was used as a last resort. The patient expired 17 1/4 hours after the beginning of labor. No uteropy.

The author considers this case a rare form because of the absence of retroplacental hematoma or internal hemorrhage, and because of the presence of the profuse external hemorrhage.

**CASE 3.** Para-V age about 35, with onset of labor about one month before term, had been doing hard physical work and had felt no fetal movements for three days before delivery. The delivery was spontaneous after labor lasting about 6 hours. When the placenta was delivered, about one fifth of the maternal surface near the margin was much darker and more friable than the remainder. This portion of the surface was covered with an old blood clot. This illustrates the effect of the partial separation of the placenta on the fetus without detaching the mother. The condition was probably due to trauma.

**CASE 4.** The patient was admitted to the hospital in labor October 15. She was delivered spontaneously of stillborn fetus on the same day. There was a history of miscarriage 5 years ago, one labor 5 years ago. Edema of the lower extremities had persisted the past 3 weeks. The last menstruation was May 15. The general condition was good, the fetal heart was not heard, there was some albumin in the urine. The placenta was delivered spontaneously and was com-

## OCCURRENCE

One of the early writers, from observation of a series of his own cases, has stated that antepartum hemorrhage is more often this type of hemorrhage than that caused by placenta previa by the ratio of 17 to 14. Other writers have found it to occur in one case out of every 156 216 513 612 cases respectively. Holmes in a recent report says that it occurs as a pathological entity in one out of every 500 cases, and clinically in one out of every 500 cases.

## ETIOLOGY

Early writers were inclined toward a theory that traumatism in such forms as extra exertion, direct blows on the abdomen, torsion of the uterus falls etc. were the contributing causes to such a condition. Such cases as the following are illustrations of this theory.

**CASE.** Lucius A. Wing reports A primipara, 28 years old, who had been bleeding for 7 hours before admission. The vagina was packed with gauze. On removal of the packing after admission no placenta could be felt. Uterine contractions occurred every 4 or 5 minutes. The fetal head presented above the pelvic brim, but did not come into the brim. Abdominal cesarean section was decided upon. An oval placenta was found, the attachment of the cord was almost marginal at the lower border. The pla-

placenta, small, and round, with a dark blood clot on its maternal surface about 5 centimeters in diameter. This represents the occurrence of a small concealed hemorrhage without serious effect on the mother but it was probably the cause of the fetal death.

Toxic conditions accompanying pregnancy had never been thought of as having any bearing on antepartum hemorrhage until cases were reported by Denman in 1807 Braxton Hicks in 1861 Goodell in 1870 Winter in 1885 and a few years later Holmes in 1901. The 3 following cases show the theories mentioned by the above writers.

Sir William Smyly<sup>1</sup> reports a case of accidental hemorrhage and contends that a cause of this condition is eclampsia.

CASE 5. Para III, age 30, previous pregnancies normal. The present pregnancy was normal until the evening before admission, when the patient was seized with abdominal pain. The uterus was hard and tender; no fetal parts were felt; there was no visible hemorrhage. The urine was scanty and loaded with albumin, casts, some pus, and red blood cells. The abdomen was opened; the uterus was dark, almost blue, with blood extravasation over its surface and there was free blood in the peritoneal cavity. The placenta was completely detached from the child dead. There was no further hemorrhage. A good recovery. Urine became free from albumin.

CASE 6. A para IX, age 39, 36 weeks pregnant, was ill about 3 weeks, suffering from headaches and impaired vision. The urine was scanty, bright red and contained large quantities of blood and tubercles. The child could be easily palpated. Diagnosis: pre-eclamptic toxemia. There was twitching of the muscles of the arms. On the fifth day after entrance there was violent pain in the abdomen; she was pale and collapsed. The skin was cold and clammy; temperature below normal; reddish discharge from vulva. The uterus was hard and tender; the fetus was no longer palpable. The abdomen was opened. The uterus was dark, bluish purple; blood extravasated throughout. The placenta was completely detached, cavity full of blood and clots, fetus dead. The patient gradually revived and made a good recovery but owing to toxic condition was restricted to soda and water for three days. The content of the urine improved and on the fourth day was normal in color and free from albumin.

Most cases of severe accidental hemorrhage are due to conditions closely allied to and identical with those which cause eclampsia.

CASE 7. M. A. Bonnet Laborde reports Primipara, age 35. The pregnancy was marked by frequent vomiting from the beginning to the sixth

month. Following that period, there was a history of fainting and violent abdominal pains, with an attack in eighth month of unusual violence. Albumin was discovered in the urine. Eclampsia was diagnosed by the local physician, and the patient was sent to the hospital. Auscultation for the fetus was negative. There was no external hemorrhage. Artificial rupture of the membranes, forced dilatation and forceps delivery of the dead fetus were done. The detached placenta, between which was a mass of blood clots, was manually expressed. During extraction voluminous black blood was discharged.

The placenta, disk shaped, presented a flattened surface, literally filled with white infarcts of all forms and dimensions, which appeared most abundant at the border. Albumin disappeared quickly and the patient left the hospital on the eleventh day.

Two recent cases, delivered in the Evanston Hospital illustrate this type.

CASE 8. A primipara age 30 came to Evanston Hospital in the seventh month of pregnancy. The blood pressure was 105-105, albumin was present in the urine and there was an increase in blood uric acid.

Soon after arrival at the hospital the patient had acute abdominal pain and faintness followed by sudden diminution in strength of labor pains. A Voorhees bag was inserted. The uterus was tense and remained so until delivery of baby. Complete dilatation was accomplished in about 6 hours. The second stage lasted 45 minutes. The delivery of a stillborn baby was spontaneous.

Placenta. The placenta showed a large area consisting of three-fourths of its maternal surface occupied by retroplacental clot which was firmly adherent. Only a narrow crescent shaped area of normal placenta was left.

Diagnosis. Premature separation of the placenta accompanied by an acute toxemia of pregnancy.

Pathology. The specimen is a placenta 17 by 12.5 by 3.5 centimeters with fetal membranes apparently complete. 46 centimeters of umbilical cord attached. On the maternal surface there is a circle consisting of a ridge of tissue about 1.5 centimeters high surrounding a depressed area in the placental substance which somewhat resembles a place where the placenta was detached and separated from the uterine wall by a blood clot. Grossly the placenta is normal. The placenta, fetal membranes, and umbilical cord together weigh 308 grams. There is also fluid and clotted blood, said to have been removed with the placenta weighing 453 grams.

Microscopic sections of the placental tissue reveal thickening of the walls of some of the arteries otherwise the chorionic villi are normal.

CASE 9. A primipara, age 29, came into Evanston Hospital, March 19, 1913, at term. She had an acute albuminuria, blood pressure 180-95, edema of ankles and legs, and slight pains with no external hemorrhage. The first stage lasted 3 hours, the



second stage 36 hours. Low forceps were applied and a living baby delivered.

**Diagnosis.** Premature separation of the placenta with no external hemorrhage accompanied by acute toxemia.

**Pathology.** The specimen is a placenta 20 by 16 by 3 centimeters with fetal membranes complete and 48.5 centimeters of umbilical cord attached. On the maternal surface there are 5 yellow white infarcts 3 to 2 centimeters in diameter. Red infarcts 2 and 5 centimeters in diameter and one hemorrhage in the placental substance 3 by 4.5 by 3.5 centimeters consist of a single dark red blood clot. The placenta, fetal membranes, and umbilical cord together weigh 650 grams.

The men quoted all referred to either mild or severe symptoms of toxemia preceding and accompanying the hemorrhage such as albuminuria, casts, rises in blood pressure, edema and blurring of vision. In a number of severe cases in which they found a true eclampsia, the hemorrhage was fatal. Two cases reported by Cavalaire, the first in 1911 and the second in 1912 were of this type. Essen Moller reported 5 cases of the same type a few years later. Williams, in 1915 reported 20 cases. Ahlstrom, in 1919 43 cases. Willson, in 1921 69 cases. These varied from cases of mild toxemia to cases of severe eclampsia.

#### AGE AND TIME OF OCCURRENCE

Willson, in 59 cases, the youngest 17 and the oldest 42 finds the average age 32.2 years. In 58 of his cases, the accidental hemorrhage occurred as follows: 5 cases in the seventh month, 10 cases in the eighth month, 21 cases in the ninth month, 2 cases in the tenth month and 1 case at a term. Of 67 cases, 26.8 per cent were primiparae and 73.2 per cent were multiparae. In 51 cases the urine showed signs of toxemia and in only 7 was it normal. In 9 cases in which the blood pressure was recorded the average pressure was 183.

Accidental hemorrhage is divided into frank and concealed but in the great majority of cases of concealed hemorrhage there has been seen a slight serosanguinous discharge. Concealed hemorrhage is best described by a report of cases such as the following:

**CASE 1.** J. Whitridge Williams reports: A primipara age 24, 7 months pregnant without previous warning, as seized with intense abdominal pain.

There was no sign of beginning labor, the cervix was hard and undilated, there was no vaginal discharge or hemorrhage. The patient was sent to the hospital and separation of the placenta was suspected. The patient became sicker and more pallid. Cesarean section was done. Upon incising the uterus, streams of clear amniotic fluid escaped under great pressure. A freshly dead seven months child was extracted, and immediately thereafter the completely detached placenta came into the uterine wound, and upon its removal a large amount of fluid and coagulated blood escaped. The uterus failed to contract, and was removed.

**Diagnosis.** Premature separation of the normally implanted placenta, concealed hemorrhage, hemorrhagic infarction of the uterus, degenerative arterial changes. Recovery.

**CASE 11.** Miles H. Phillips reports: A multipara, age 33, had had nine full time pregnancies and one miscarriage, with postpartum hemorrhage on several occasions, antepartum bleeding at last confinement. When about 8 1/2 months pregnant, she awakened in the morning with severe abdominal pain, and fainted. There was no visible bleeding. She was removed to the hospital. On admission, there was pain all over the abdomen, the uterus was large and tense, there was no hemorrhage from the vagina, the cervix was firm just admitting two fingers. As soon as the membranes were touched by the gloved hand, a huge gush of blood poured from the vagina. The vagina was packed, blood escaped through the packing. Abdominal section was done. A large quantity of blood and blood-clot came away from the interior of the uterus. The child was as white as the mother. The placenta was found loose on the posterior wall of the fundus, completely separated from the placental site, which was later found to be on the anterior wall. The membranes were intact. The flabby uterus was amputated. There was slow but steady recovery. On the fourteenth day thick white slough projected through the external os, during the next ten days similar pieces of slough presented. The author thinks the sloughs were produced by septicemic necrosis of lining mucous membrane and possibly also of part of the muscular wall of the uterine stump. The causation of the antepartum hemorrhage was not obvious. The placenta appeared healthy but as not examined microscopically the child was well developed there, as no albuminuria or other sign of toxemia, the patient had not met with accident although she had been working hard.

The frank type of hemorrhage is best described by the following report of cases.

**CASE.** Barclay Lankford reports: A primipara, age 26, with pregnancy normal until about ten days before time labor was predicted. In the morning she began to have slight but steady flow of blood, neither bright red nor yet very dark. The pains recurred at short intervals. The fetal heart as not heard. The cervix was dilated to the size of a quarter, no portion of the placenta was felt. She was sent to the hospital.

Abdominal binder was applied. In the afternoon a dead fetus was delivered, followed immediately by several handfuls of dark clots and the placenta. The latter was very interesting. An old, tough, blood clot had practically taken the place of all placental tissue except immediately around the margin, here there was a ring of normal looking placental tissue at no point more than an inch wide, and at several points much narrower. When the clot was separated from its bed, which was done with some difficulty as it was so firmly adherent there was nothing of placental tissue found beneath it, but the membranes were there. No history of trauma or accident could be elicited.

**CASE 13.** Leake H. S. DeWitt, reports. A multipara, age 35, in her fifth pregnancy. Probable confinement was estimated as January 1. The first hemorrhage occurred August 24, with no pain. During September and October there were two similar hemorrhages. November 5 there was a profuse flow with some pain similar to labor pains. She was admitted to the hospital on November 9. There was some bleeding. No placenta could be palpated. The bleeding recurred and it was thought best to empty the uterus. Dilatation version child easily delivered. The placenta immediately appeared at the vulva together with many old clots. About two-thirds of the placenta was infarcted and had no attachment. The child was a premature infant of 7 months. Four hours after the operation the patient cried out that she could not get her breath. All treatment was ineffective, and she expired thirty minutes after the attack. The condition may be explained by a primary syphilis with secondary pyrogenic infection.

**CASE 4.** Williams reports. A multipara, age 8, 9 months pregnant, with some edema of feet and a definite amount of albumin in the urine. Labor pains began the evening before admission, and at 6 a. m. a gush of blood occurred from the vagina. On admission a considerable amount of dark red blood was escaping from the vagina. The fetal heart sounds were not heard, the placental tissue was not felt. At caesarean section, a dead child was extracted. Immediately following delivery the placenta appeared in the wound, and, as it was extracted a large amount of partially clotted blood escaped with it. As the uterus did not contract, supravaginal hysterectomy was done. A tumor developed in the right lower quadrant. The tumor mass was opened, and greenish pus escaped. The patient improved rapidly and at the end of a month was discharged.

**Diagnosis.** Premature separation of the normally implanted placenta, with combined concealed and external hemorrhage. There was hemorrhagic infarction of the uterus, right tube, and ovary also extensive thrombosis and peculiar degenerative arterial changes.

Three recent cases from the Evanston Hospital are typical of this type of hemorrhage.

**CASE 15.** Primipara, age 36, at term, April 3, 1923. The pregnancy to date was normal. General

physical examination was negative. On March 5, 1923, while sitting in her living room reading she had sudden acute pain in the lower abdomen. This was followed immediately by profuse vaginal hemorrhage so profuse that her trip to the bath room could be easily followed. The patient was seen by the doctor 30 minutes after the hemorrhage occurred. The following symptoms were noted: pallor, rapid pulse and restlessness. The patient seemed very much worried. Bleeding continued in mild degree resembling that of menstruation, and the patient was taken to the hospital. There was no pain following the original attack until after the patient arrived at the hospital. The pains then occurred every 2 minutes. Following a hypodermic 0.1/6 grain of morphine the pains and bleeding ceased. On March 7 the pains again started and there was a slow advancing dilatation of the cervix. The fetal heart was heard until 6 p. m. on March 7 but was not audible 2 hours later at 8 p. m. The first stage of labor ended at 9:40 p. m. March 7. The second stage was 53 minutes in duration, at the end of which period the head had advanced to mid-plane. An anesthetic was given and a dead child extracted with forceps. In the third stage there was nothing abnormal.

**Diagnosis.** Abruptio placentae with birth of dead fetus.

**Pathology.** The specimen is a placenta 20 by 6 by 2.5 centimeters with fetal membranes apparently complete and 5 centimeters of umbilical cord attached near one border. On the maternal surface are two huge blood clots 6 by 4.5 by 2.5 centimeters and 5.5 by 3.5 centimeters attached to the placental substance and here also there is a red infarct 3 by 2.5 by 1.5 centimeter. A blood vessel here is thrombosed. Near one margin of the area is a yellow white infarct 1 centimeter in diameter. Otherwise the placental substance is unchanged. The placenta, membranes, and umbilical cord together weigh 404 grams.

**Diagnosis.** Hemorrhage into the placental substance red infarct of the placenta white infarct of the placenta.

**CASE 16.** A primipara, age 25, with normal pregnancy came into Evanston Hospital 1 term. Soon after arrival she had an active vaginal hemorrhage. Vaginal examination showed one finger's dilatation and floating head. There were no uterine contractions. A caesarean section was performed, and a living baby delivered.

**Diagnosis.** Premature separation of placenta with external hemorrhage. Placenta showed no gross lesion.

**Pathology.** The specimen is a placenta 20 by 20 by 2.5 centimeters with most of the fetal membranes missing and 5.5 centimeters of umbilical cord attached. The placental substance is grossly unchanged. The placenta, fetal membranes, and umbilical cord together weigh 613 grams.

**CASE 17.** A multipara, age 34, had had a normal pregnancy until June 0.3 days before the time set for delivery. The patient was awakened early in the morning by severe vaginal hemorrhage followed in

one hour by the first mild labor pain. Pains recurred every 30 minutes and the patient entered the Evanson Hospital 2 hours after the hemorrhage. After her preparation for labor the pains became more frequent every 3 to 5 minutes. There was no bloody discharge. During the next two hours the pains increased in frequency and severity. At the end of this period there was three fingers dilatation and about 75 per cent effacement. Three minims of pituitrin was given and 5 minutes later the patient had profuse sterile bleeding. The patient was prepared and vaginal examination made. No placenta could be felt. The head was in the mid plane, and was delivered with low forceps. A 6 lb baby was delivered and the mother had an uneventful recovery.

**Diagnosis.** A fresh retroplacental clot was found at the margin of the placenta diagnostic of a partial premature separation of the placenta.

**Pathology.** The specimen is a placenta 30.5 by 7 by 2.5 centimeters with fetal membranes complete and 46 centimeters of umbilical cord attached. Attached to one border of the placenta there is a piece of freshly clotted blood 2.5 by 4 by 1.5 centimeters. The maternal surface is smooth. The placental substance is grossly normal. The placenta, fetal membranes, and umbilical cords together weigh 683 grams.

The placenta may be partially separated or wholly separated. In the majority of cases we find the placenta entirely separated. For example in 48 cases reported by Willson, the separation was complete in 36 cases and partial in 12 cases. In a few instances the placenta has been expelled from the uterus before the fetus. This very rarely occurs. W. D. McFarland of Glasgow in 1911 reported the following three cases:

**CASE 8.** Para-VIII aged 38 had formerly been under care for metro endometritis. The pregnancy was normal. During the thirty sixth week, she was seized with sudden pain, intermittently, then a sudden discharge of water followed, and she felt something protruding from the vagina. The placenta was found lying on the bed. There had been no bleeding. The head was filling half dilated cervix. As the child was dead, the patient was left to deliver herself, which was accomplished 2 1/4 hours after the birth of the placenta. The longest measurement of the placenta was 1 1/4 inches, and at no part was its thickness half an inch. Around the margin of the placenta, on its maternal surface, were white infarcts, varying from the size of split peas to that of a horse bean; this condition extended around the margin of the placenta for about three-fourths of its circumference.

**CASE 9.** A Para V age 34, in the twenty-eighth week of pregnancy had labor pains proceeding a little over an hour when the membranes ruptured. The placenta, as found presenting at the vulva. The cord was not pulsating, so the case was left to nat-

ure. The child born in three and one-half hours had evidently been dead for some days. There was no bleeding, and none accompanied the separation of the placenta. The formation of the placenta, as normal in outline and the size and thickness were also normal. There were numerous large and small red infarcts along the margin of the maternal surface and also in the substance.

**CASE 20.** A multipara, aged 28, had had normal pregnancy until thirty-second week, when labor began. The membranes ruptured early. The placenta was found lying on the bed clothes. The child, dead, was delivered 3 hours after birth of the placenta. Along the periphery of the maternal and fetal surfaces of the placenta were numerous white infarcts, and three comparatively recent encapsulated hemorrhages in the substance of the placenta situated close to the margin on the maternal surface. No hemorrhage occurred either before or after the birth of the placenta.

#### PATHOLOGICAL PICTURE

The pathological picture of the placenta and the uterus in an average case of this type given by Willson in his summary of the cases which he reported January 1911 is as follows:

**Macroscopical appearance of the uterus.** At autopsy or laparotomy the uterus presents a very striking picture, its appearance being compared by many to that of an ovarian cyst with a twisted pedicle. The whole organ may be almost black or mottled throughout from the presence of the effused blood in its walls or under the peritoneum or one lateral half or the anterior or posterior surface may appear normal and the opposite portion show the characteristic discoloration.

**The myometrium.** As might be expected the extent of the hemorrhagic infiltration of the uterine musculature varies greatly. Subperitoneal ecchymosis due to extravasation of blood under the peritoneum seems to be present in all cases, and in a few it is the only lesion noted. Between such cases as these and those in which the whole uterine wall is literally inundated with blood all stages in the process are encountered. The hemorrhage constantly tends toward separating and tearing apart the muscle bundles, but it is only in the areas where it is most intense that the individual fibers are separated from each other. This rarely occurs. In such localities the muscle bundles may be seen occasionally as strands of tissue traversing great lakes of effused

blood. Edema is very frequently noted, and areas free from hemorrhage often show much edematous infiltration. Increase in the amount of connective tissue is noted occasionally. Round cell infiltration around some of the hemorrhagic foci has been noted and also the presence of leucocytes containing blood pigment. Such areas probably indicate that successive effusions of blood occur some older and some more recent.

The distribution of the hemorrhage in the uterine wall is interesting and, from an etiological point of view most suggestive. The process is always more profuse in the region of the fundus and upper part of the body and the lower uterine segment seems to be frequently entirely spared. In the great majority of the cases the area of the uterine wall over the site of the placenta is the most involved and the extravasation is usually greater on the anterior for posterior or lateral aspect of the uterus, depending upon the location of the placenta. Another striking finding is the tendency of the hemorrhagic process to reach its maximum under the peritoneum. There are a few exceptions to this but the great majority of the observers note particularly and specifically that it is the outermost layers of the myometrium which show the densest and deepest discoloration from the bloody effusion. In this connection it should also be remembered that in the milder cases the lesion may be limited to subserous oohymoses. Even over the area of placental attachment the layers of musculature adjacent to the decidua may show only punctiform bleeding, which increase as the peritoneum is approached until the outermost third of the thickness of the uterine wall is literally torn asunder by a massive and brutal hemorrhage. This is illustrated most strikingly in the colored plate of Fordyce and Johnstone, showing a cross section of the uterus through the placental site at a level just below the tubal insertions.

The observations regarding the condition of the muscle fibers themselves are rather contradictory. In 14 cases in which this point is mentioned they are stated to have been normal or healthy in 7 cases and abnormal in 7 cases. The most detailed study of the muscle fibers was made by Ley. He found marked

degeneration present in three uteri studied. The degeneration seemed to be more marked in regions where the hemorrhage was greatest was not secondary to the hemorrhage but was due to the same cause namely the action of a toxin. The process was severe enough in some cases to reduce the muscle bundles to a vacuolated matrix in which lie a very few tortuous narrow hyper and hypo-chromatic nuclei." The individual fibers in such areas could not be recognized.

*The decidua.* The changes in the decidua are always more grave in the decidua basalis than in the parietal decidua. Hemorrhage is the most marked lesion and is extensive enough in a few cases to cause complete disorganization. Degeneration and necrosis of the decidua cells has been noted. The decidua vessels show congestion. In the case of Young (the specimen of the case reported clinically by Kynoch) it is stated that the decidua vessels were dilated into enormous thin-walled sinuses. Ley mentions a partial closing of the decidua vessels by proliferation of the intima in one case and some perivascular infiltration in another. Inflammatory lesions were not noted in any case and their absence was noted specifically in a few cases.

*The blood vessels.* Congestion particularly of the veins, is quite uniformly present. Thrombosis of the veins in the uterine wall particularly in the neighborhood of the placental site is noted in several cases. Convelaire and Williams noted solutions in the continuity of the walls of some veins communicating with the areas of effusion. Williams and Morse noted changes of an endarteritic nature in the walls of the smaller arteries, but the latter states that these did not differ from those usually encountered in the uteri of multiparous patients. Maxini noted thrombosis in some vessels and a homogeneous appearance in the walls of others. Young states that

a massive extensive, and fairly old standing thrombosis was found in the ovarian vessels on each side, especially the left. "The uterine vessels seem to be healthy." Perivascular infiltration was noted by Ley who also states that the changes in the vessel walls did not seem to differ from those noted in the surrounding tissues. Berggren, v Weiss Frai

pont Courvelaire Essen Moller and Alhstrom, all note the vessel walls as being normal.

*The peritoneum* The presence of subperitoneal hemorrhagic effusion in all cases has already been noted. The most striking lesion in the peritoneum, however and one of great importance from both a clinical and pathological point of view is the presence in many cases of fissures or ruptures in the peritoneum, extending occasionally to the depth of a few millimeters into the subjacent muscularis. These are noted in 11 cases (Essen Moller Iraipont, King, Knauer LeLorier Ley McNair Shaw Smith Smyly and Zweifel). This represents an incidence of approximately 15 per cent. They may be single or multiple. Their direction is usually transverse but they may also be directed in the long axis of the uterus, or have an irregular arrangement. Their position is usually on the anterior or posterior wall in the region of the fundus. It is very probable that they occur in most instances directly over the placental site and such a location is definitely shown in 3 cases. I have not included in this series several cases in the literature in which the peritoneal fissures have been noted in a position with accidental hemorrhage but in which nothing is said regarding hemorrhage into the uterine wall. There would seem to be little doubt, however that these belong to the type of condition under discussion. Such cases are reported by White Shannon Macrone and Werner. The case of White is particularly interesting because it is, in all probability the first case of uteroplacental apoplexy in the literature. The patient a 32 year-old para IX, died about an hour after the delivery of a stillborn fetus. Nothing is said about external or concealed hemorrhage but autopsy showed the characteristic peritoneal lacerations hemorrhagic extravasations into the broad ligaments, and intra abdominal bleeding. This case was reported in 1834.

*Intraperitoneal effusion* In 31 cases in which this point is mentioned the presence of an intraperitoneal effusion is noted in 22 cases, an incidence of 71 per cent. The character of the effusion varied from a clear serum to pure blood. The amount varied from a slightly increased quantity of peri-

toneal fluid to an intra-abdominal hemorrhage quite comparable to that caused by a ruptured ectopic pregnancy. In the majority of the cases the source of the bleeding is evidently the superficial lacerations described above. In one case it came from ruptured vessels in the broad ligament. In another it is believed to have come from the wall of the tubes and in still another it was at least contributed to by complete rupture of the uterus. The cases with bloody serum frequently showed no peritoneal tears, the opposite being true when free blood was present.

*The adnexa* Not the least interesting feature of the pathology is the participation of the tubes, ovaries and uterine ligaments in the hemorrhagic process. The broad ligaments were involved in 26 cases, the tubes in 11 cases the ovaries in 4 cases and the round ligaments, once. These were of course, associated in various combinations. The lesion in the ovary was usually simply the presence of punctiform hemorrhage. In one of Williams cases this was extensive enough however entirely to isolate some graafian follicles in a bloody effusion. Punctiform hemorrhage in the tubal wall was the usual lesion but was occasionally extensive enough quite to disorganize it. The process in the broad ligaments varies greatly in its extent from the presence of ecchymotic spots to collections of blood which justify the term hematoma. The hemorrhagic effusion may even extend beyond the broad ligaments. In one case it extended onto the bladder and posteriorly retroperitoneally as far as the caecum on the right and the mesosigmoid on the left. In another case it extended up behind the caecum and in a third up behind the sigmoid. The lesions in the broad ligaments, tubes and ovaries are frequently unilateral one side being free and the other involved or the process is much worse on one side than on the other. Where this obtains there is distinct evidence to show that the severity of the condition is governed mainly by the location of the placental site being worse on the side toward which the placenta tends to have its greatest area of attachment.

*The placenta* With the exception of infarcts and the compressed zone corresponding

to the area of the retroplacental hematoma the few recorded examinations of the placenta have shown an absence of pathology. Slight thickening of the stroma of the villi was noted in a few cases.

*Lesions in other organs.* There are more or less complete autopsy notes in 17 cases. The lesions in the liver are hemorrhage usually subcapsular and acute parenchymatous degeneration. Hemorrhage without necrosis was present in 2 cases. Degeneration was noted 7 times and was central in 2 cases and peripheral in one. Hepatic cirrhosis was noted once. In one case it is stated that no normal liver tissue was left. The liver is stated to have been normal on macroscopical examination once. The usual lesion in the kidney was acute parenchymatous degeneration this is noted 7 times. Chronic nephritis is noted twice. The kidneys are reported as normal on gross examination once and on microscopical examination once. Hemorrhage in the diaphragm was present twice, in the pericardium once, in the meninges once, in the mucosa of the stomach twice, and in the adrenals once. One patient had apical tuberculous.

*The fetus.* There are 2 autopsies on the fetus reported, one by Couvelaire, and one by Oldfield and Hann. In each instance extensive hemorrhages into various viscera were noted. Are these lesions the result of the asphyxia caused by placental separation or are they a manifestation of the similar lesions in the mother? As yet this question can not be answered. It is interesting to speculate, however in view of recent claims that cerebral hemorrhage in the newborn is often not of traumatic origin but due to dyscrasias of the fetal blood, whether a possible antenatal poisoning of the fetus may not exist in some cases, which will enable us to trace an etiological relationship between cerebral hemorrhage in the newborn and maternal toxemia.

#### DIAGNOSIS

Holmes, in his report, stated that this condition was diagnosed by clinical symptoms, only once out of every 500 cases. There is no doubt but what the same condition occurs in mild forms in many of our cases. Little is

thought of a patient during the early stages of her labor complaining of constant severe pain in the abdomen accompanied with some vomiting and bloody discharge but no doubt if the entire case was more carefully observed and the placenta carefully examined we would be able to report more cases of premature separation of the normally implanted placenta. I have in mind a few cases in which the differential diagnosis between placenta prævia and premature separation of the placenta was very difficult and although such a condition as a combination of the two is impossible according to a recent authority I wish to report the following cases as illustrations.

CASE 31. G. J. McIntosh reports the case of a multipara, age 73, normal labor, always in good health. She expected to be confined about April 30. In February she lifted a heavy object weighing about 75 pounds. That evening she felt considerable pain in left lower quadrant of abdomen. All during February the pain continued. February 4 she was found in condition of shock. Abdomen was distended and tense and no blood had escaped externally.

While I was washing up to examine her there was a great gush of thin, very dark-colored fluid. So great was the amount that I concluded that the sac had ruptured, but such was not the case. The cervix was soft and admitted two fingers. The edge of the placenta could be felt near the presenting head. She was moved immediately to the hospital. Manual dilatation 3 reeps. After extraction of the baby a very large amount of dark clot was removed. There was no more hemorrhage; the patient was apparently bled dry. She lived about an hour after the baby was delivered.

CASE 32. A multipara, age 35, had had 6 normal labors, and had now been pregnant about seven months. She had fallen down stairs and her condition was similar to that in Case 31. When making digital examination, thin dark blood gushed away in large amount. She expired suddenly while preparations were being made to extract the child.

In both cases a physician was not summoned until intra-uterine hemorrhage had attained fatal proportions.

CASE 33. Reported by M. Garipuy. The patient was attended by midwife partly not in age 23, 8½ months pregnant. Much albumin in the urine persisted to the moment of labor. The pregnancy was normal with the exception of the presence of albumin. There was sudden, very abundant hemorrhage eight hours after the beginning of labor pains with cessation of movement of fetus and other

grave symptoms. The midwife attempted to check the hemorrhage with cold vaginal injections. In the meantime the bag of water ruptured and the hemorrhage persisted. The midwife attempted to revive the fainting patient with ether and subcutaneous injections of caffeine. The author arrived at the moment the patient was regaining consciousness. Diagnosis: separation of placenta, perhaps previa.

The head of the child was engaged, the cervix was dilated only 3 or 4 centimeters the membranes were ruptured. Bimanual dilatation failed. Lateral incisions à la Doernum, with application of forceps delivered a dead fetus of a size corresponding to length of pregnancy. The placenta delivered. On the fetal side of the placenta there was a large new clot covering about two thirds of the surface. Distance of border of placenta from opening of membrane, 15 centimeters.

The hemorrhage ceased on termination of labor. Albumin disappeared entirely.

CASE 24. Reported by Burnley Lankford. A para-III, nine days after the date of predicted labor in the morning while at her housework, had sudden gush of blood, but no pains. The least change of position caused blood to gush. She was removed to the hospital. Examination showed membranes intact, poached down much further than normal, the placenta could not be felt. Blood flowed freely during examination. Dilatation membranes ruptured. The cervix was beginning to tighten a bit. 4 intervals, showing labor pains were probably starting. Tight perineal pad was applied, together with tight abdominal binder, and the patient was returned to ward to await developments. The patient delivered herself rather precipitately of a lusty male child, late in the afternoon. A few clots came directly after delivery and the placenta, being found in the vagina in about five minutes, was easily expressed, followed by more clots. The placenta showed a white, tough infarct about 1 inch in diameter, near the margin. There was a hole in the center of the infarcted area probably  $\frac{1}{4}$  inch in diameter leading down to the membrane.

CASE 5. J. P. Hartman reports the case of a para-III, age 35 with history of diphtheria, complicated with nephritis at 9 years. There was edema during the first pregnancy and albumin in the urine during the second pregnancy. In the sixth month of the third pregnancy there were symptoms of old nephritis, and during the last three months edema and albumin in the urine. On examination, the placenta was felt and placenta previa suspected. A rubber balloon was introduced. After seven hours amniotic fluid escaped with blood clots. Pressure on the uterus expressed the placenta, followed by a six month's fetus. The mother did not respond to stimulants and died at midnight. The placenta had the characteristic appearance of premature separation. There were infarcts over an extensive area and large blood clots, one was as large as a walnut on the maternal surface of the placenta. There were old firmly compacted blood coagulations.

Autopsy: Chronic nephritis left kidney hypertrophied, transudation fluid in pericardium and peritoneum; all organs picture of anæmia. Placental attachment high at the back of fundus.

CASE 26. Holmes reports a border line case between placenta previa lateralis and ablatio placentæ in para III, age 3. During this pregnancy she suffered from constipation, had poor appetite, and toward the end swollen legs. During the first three months there was an almost constant discharge of blood, thereafter at intervals of three to four weeks she would have pains as if labor were commencing with gushes of white fluid. The labor pains were strong, there was slight hemorrhage. The next morning the membranes ruptured, hysterectomy then craniotomy. Credé. The placenta offered nothing characteristic of ablatio placentæ. The opening in the membranes was about seven centimeters from the placenta in the shortest distance. Placenta showed no gross manifestations to explain the hemorrhage, beyond some darkening of the lower half of the maternal surface. Chorion offered no clue as to the precedent by *dromæa gravidarum*.

One important point in the differential diagnosis of placenta previa and premature separation of normally implanted placenta is a careful examination to ascertain whether or not the placenta can be felt. In two of the cases just reported the placenta was felt, which would signify a placenta previa, but following surgical or obstetrical investigation the placenta was found to be entirely free. Personally I am unable to conceive of a condition of this kind being a simple placenta previa. Unfortunately the placenta in these cases were not examined for areas of infarction or for areas covered by organized clots. Such cases as these are most interesting to me, and I will gladly accept any explanations as to what to place as the cause of the separation of the placenta if these cases are to be called simple cases of placenta previa.

#### TREATMENT

The treatment of this condition depends upon the amount of hemorrhage, external or concealed on the amount of toxæmia and upon the amount of dilatation. In those cases, especially in primipara in which the cervix is tight and the symptoms of concealed hemorrhage such as shock, pallor, thirst, rapid pulse, and pain are present, the only treatment is surgical, the classic cesarean section being preferred, the vaginal section

contra-indicated principally because of the field being flooded by hemorrhage. The following case will be sufficient to illustrate the above statement.

CASE 27. W. Fordyce and R. W. Johnstone report the case of a primigravida whose confinement was expected July 16. June 17 the physician was called because of a "breathless attack," some edema of the legs and constant pain in abdomen. There was slight external hemorrhage, no fetal heart sounds were heard. Vaginal examination was negative. She was removed to the hospital. Urine was scanty and contained a large quantity of albumin. Diagnosis of concealed accidental hemorrhage with progressive toxemia was made. Cesarean section was done. The upper part of the anterior wall of the uterus was congested and hemorrhagic. The placenta lay on the posterior and right lateral walls. It was separated from the right lateral wall by a large retroplacental clot, while its left half was still attached to the posterior uterine wall. A dead child was immediately extracted. The placenta was detached manually. Supravaginal hysterectomy was done because of the condition of the uterus. The patient died 4 hours later in an eclamptic seizure.

Fordyce and Johnstone say that the view generally accepted by most writers is that both the retroplacental hemorrhage and the eclampsia or eclamptism are manifestations of one common underlying toxemia of pregnancy. Because of different views held, however, he is doubtful if any definite conclusion can be reached. He thinks all such cases should be recorded for study.

It is becoming more and more the tendency to treat these cases, which are not too severe obstetrically. During the last 3 years, we have had three cases in the Evanston Hospital which have been treated in this way. The report of these is as follows:

CASE 28. A para V, age 42, gave history of edema and albuminuria during the first pregnancy; the other four were normal. At term, January 10, on December 28 the membrane ruptured at 8 a.m. she arrived at the hospital at 9.30. There was four fingers dilatation with pains every three minutes. There were no fetal movements and the heart was inaudible. Delivery was spontaneous at 10 a.m. The placenta was completely delivered in 30 minutes. There was large area of infarct in the middle of the placenta, one third of the whole area was involved. Diagnosis: Recent apoplectic form placenta.

CASE 29. A primipara, age 27, at term, January 30, began labor at 2 a.m. on January 31. She was taken to the Hospital at 3.30 a.m. and was seen by the attending physician at 4.30 a.m. The uterus was dis-

tended and tense with fluid wave present. No heart tones were heard. Position was indistinct, one finger dilatation. The progress was slow; morphine was administered twice. Dilatation was complete at mid night, then the outline of parietal bones were felt. The meconium was coming away.

Second stage. The head descended to the perineum, and a low forceps delivery was done. Many clots followed child out of uterus, the placenta was expelled in ten minutes. The placenta was 80 per cent detached. Diagnosis: Premature detaching of placenta. Fetus showed beginning maceration.

CASE 30. Para III, age 29, went to labor 5 p.m. May 6 and was seen by the attending physician in the hospital at 6 p.m.

First stage. Two and one-half finger dilatation, head movable, membrane unruptured, no heart tones, no placental sounds, pains every four minutes, labor normal with rapid dilatation.

Second stage. Short, easy delivery, spontaneous, small dead unmacerated child, large amount of old clots following child.

Third stage. Placenta expelled in 10 minutes, many old clots, deeply infarcted placental area of recent hemorrhage. Diagnosis: Premature detachment of placenta with intra uterine bleeding.

In these last three cases the delivery was spontaneous.

The following three cases illustrate more active obstetrical interference.

CASE 31. Reported by F. L. Adair. A multipara, age 30, who had had no miscarriages, one premature birth at 7 months, eight full term pregnancies all uneventful, was now at term. For a couple of weeks she had noticed some blood. When labor pains began there was more bloody discharge, with constant pain in abdomen and back, general condition poor, pallor, abdomen distended and tender. Fetal parts could not be palpated and no heart tones heard. No placenta was felt, there was considerable bloody vaginal discharge. Manual dilatation; version still-born male child delivered. Placenta came away at the same time, followed by some dark blood clots. There was very little fresh bleeding. One hour later the patient became suddenly worse and developed symptoms of pulmonary edema. The respiration ceased, though the heart kept on beating for about half an hour.

CASE 32. A multipara, 38 years old, 8 months pregnant, four hours previous to entrance felt severe pain in right side. Examination at the hospital revealed pulse 136, clothes soaked with blood. Version, dead child delivered. The placenta was born before the cord could be clamped. The placenta was small, and one-half was infarcted, the other half covered with fresh and old blood clot. The patient was discharged on the tenth day. The urine still showed a slight trace of albumin with an occasional hyaline cast.

CASE 33. Virginus Harrison reports the case of a primipara, age 37, with last menses September 15.



who was taken sick April 1 with intermittent cramps and external bleeding. April 4 there were severe pains with very little bleeding. April 5 she entered the hospital with some bleeding and regular labor pains. The fetus could not be outlined. Manual dilatation rupture of bag of waters breech presentation. With little traction on a foot the uterus soon expelled a macerated fetus of about 5 months. The placenta was removed manually with no difficulties, as it was completely detached. About half a pint of old dark clots were removed from the uterus. The placenta was covered, with the exception of a space of the size of a half dollar, with an old clot about a half inch thick and very black. The placenta was made up of numerous infarcts of varying degrees of thickness and color indicating that the woman had had numerous hemorrhages into her placenta until the fetus got so little nourishment that it did not grow to its full size. It also showed that thrombosis had taken place to such an extent that nature was enabled to stop the bleeding from the remaining sinus. Patient a little anemic but on a fair road to recovery. Urinalysis showed a slight nephritis.

## CONCLUSIONS

1 Mild cases of premature separation of the normally implanted placenta are more frequent than is commonly believed.

2 Etiologically this type of hemorrhage can be classified as toxic and traumatic the latter being much in the minority.

3 Mild toxemias are capable of producing small areas of infarction with resultant mild hemorrhages, with little discomfort to the mother but fatal to the baby.

4 Approximately the same toxemias of pregnancy resulting in eclampsia are responsible for a premature separation of the placenta.

5 Expectant treatment should be resorted to in all mild cases of premature separation of the placenta. In extreme concealed hemorrhages, the treatment should be surgical preferably cesarean section.

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THE ETIOLOGY AND TREATMENT OF NON TUBERCULOUS PULMONARY ABSCESS<sup>1</sup>

By WYMAN WHITTEMORE, M.D. F.A.C.S. BOSTON

THE etiology of non tuberculous pulmonary abscess is important for the reason that a very large percentage of these cases could be avoided by more careful technique in performing operations upon the upper respiratory tract under general anesthesia. The etiology in the last 100 cases of my own could be definitely established in all but 8 and is as follows. In 66 cases there had been an operation on the upper respiratory tract under general anesthesia, directly preceding the lung infection (In 48 cases tonsils were removed in 12 teeth extracted in 2 septic sinuses drained in 1 adenoids removed in 1 a deviated septum straightened in 1 a broken nose operated upon and in 1 a tracheotomy was done.) Pneumonia was the cause of the abscess in 22 cases (bronchopneumonia occurring 10 times and lobar pneumonia twice.) Septic infarct was the etiological factor in three instances and a bronchial esophageal fistula in one.

Other causes not included in this series are operations for malignant growths of the jaw and tongue, extension of infection into the lung from a focus outside of it (as for example subdiaphragmatic abscess, mediastinal abscess rupture of an empyema into the lung) actinomycosis foreign bodies, including not only those that are aspirated into a bronchus but projectiles lodging in the lung (the former in my opinion are more apt to produce a localized bronchiectasis with bronchiectatic abscess or abscesses than a simple pulmonary abscess) and the aspiration of infected water while swimming.

These figures of my own—66 cases out of 100 in which the lung infection was directly preceded by an operation on the upper respiratory tract performed under general anesthesia—are startling. It does not lie in the province of this paper to discuss how the infection of the lung takes place there being several theories, except to say that the most common sense one at least to my mind is

that it is due to the aspiration of infected material during the operation. It seems only fair to state that the percentage of cases which develop pulmonary abscesses following these operations on the upper respiratory tract must be exceedingly small when the thousands of tonsillectomies and extractions of teeth that are done every day are considered. Although pulmonary abscess occasionally follows an operation performed under local anesthesia, yet there is none in this series. It is only just to the nose and throat specialists to add that, in this series only one case had been operated upon by an expert.

## TREATMENT

Treatment may be divided into expectant (or medical) artificial pneumothorax, bronchocopy and operation.

In *expectant treatment* the patient is kept quiet in bed given good nourishing food, fresh air and sunshine and an attempt is made to keep the cavity emptied by postural drainage. Two or three times each day the patient should be placed in a position (usually with head over the side of the bed) which will cause the abscess to drain into a bronchus and then its contents may be coughed up. For this treatment to be successful intelligent co-operation on the patient's part is necessary. In 86 cases of my own 11 recovered with this treatment (10 per cent). In Lord's (5) 100 cases 7 spontaneously recovered (7 per cent). Lockwood (4) reported 16 recoveries out of 27 cases (51 per cent). This is the largest percentage of recoveries that I have seen reported. Weiler (10) states that in 33 per cent of all cases of acute pulmonary suppuration following tonsillectomy the patients recover spontaneously within 2 months. Statistics collected by Lenharts (3) from three municipal hospitals in Berlin, 1905 showed that there was a mortality of from 60 to 100 per cent following expectant treatment. There is always danger of brain abscess, meningitis

septicæmia, extension of the process in the lung and fatal hæmorrhage. This risk must be taken into consideration when expectant treatment is advised. In practically all cases it is justifiable to give the patient a trial with this treatment, under close observation before operation is undertaken. As long as there is a steady gradual improvement, the expectant treatment may be continued but, if at any time this ceases or the condition of the patient becomes worse, surgery should be strongly considered.

*Artificial pneumothorax.* This may be used in conjunction with postural drainage in early cases in which the lung and costal pleura are not firmly adherent. In the cases in which there are strong adhesions I have never seen any evidence pointing toward a permanent cure. In certain cases, following artificial pneumothorax, the foul odor of the sputum and breath lessens very much or indeed disappears, and the paroxysms of coughing may be temporarily relieved, but they soon return. Tewksbury (8) has reported 14 cases treated by this method in which there were 11 cures and 2 deaths. On the other hand, the literature for the last 19 years shows an absence of any considerable number of successfully treated cases. How long this treatment must be continued in the favorable cases (those that are early and not adherent) must depend on each individual case, but it seems probable that it must extend over a period varying from 3 months to a year or possibly longer. The danger of air embolus should be remembered, and, also when there are adhesions present the artificial pneumothorax may in tearing or stretching these, open an abscess that is situated in the periphery of the lung and cause an empyema. (I have had one such experience.) Artificial pneumothorax may be of benefit in determining whether or not adhesions are present. I cannot believe that any large number of cases will be cured by this method but feel that a small percentage may.

*Bronchoscopy.* Aspiration of the abscess by means of the bronchoscope in the special list's hands, with the dilatation of bronchial strictures, if present, may improve the condition. Indeed several cases of permanent cure

have been reported. (It is my belief that foreign bodies lodging in a bronchus produce a bronchiectasis, or bronchiectatic abscess, rather than a simple pulmonary abscess, and in these the removal of the foreign body frequently cures the suppurative condition.) If this treatment is begun at an early stage of the disease it is reasonable to expect better results from it than if it is not begun until the condition has existed for months. Willy Meyer (6) reports two cases cured by Lynah. One followed aspiration of the stomach contents during an abdominal operation and the other had been preceded by a tonsillectomy. The first case was cured after 6 months of bronchoscopic aspirations done at regular intervals. The second case was cured after one such treatment. In both instances this treatment was instituted early. Meyer also reports four similar cases treated by Richard Jordan (3 in conjunction with Lynah) in which permanent recoveries were obtained. In the long standing cases some improvement may take place with this treatment, but it seems very doubtful if any permanent cure would result. It may be that this treatment combined with surgical drainage would be of value, especially in those cases which do not progress satisfactorily following operation.

*Operation.* All cases in which the lung and costal pleura are adherent can and should be operated upon under local anesthesia, provided the approach to the abscess has been correctly chosen. When the operation is performed under local anesthesia if at any time the patient coughs and raises pus, it can easily be gotten rid of whereas, if he is under general anesthesia, any pus that reaches the main bronchus may be aspirated into the lung on the opposite side. If a section of one rib only is to be removed local blocking of the intercostal nerves above and below the rib, after the skin has been anesthetized, is all that is necessary. When a section of several ribs is to be removed paravertebral anesthesia should be used. In this the intercostal nerves are blocked close to the vertebral column. This anesthesia is perfect when the approach is from the back or posterior axillary line. If the site of operation is more anterior local anesthesia may be used to supplement this

When the lung and costal pleura are not adherent and the normal pleural cavity (one without any adhesions in it) must be opened in order to localize the abscess some form of differential pressure anaesthesia should be used. There are four possible methods. First the negative pressure chamber (Sauerbrück's chamber) second, intratracheal insufflation (method of Meltzer and Auer) third pharyngeal insufflation fourth, the mask apparatus—the mask of a gas oxygen machine when fastened snugly to the face works satisfactorily. The pressure obtained from the gas oxygen machine is sufficient to keep the lung well expanded. I prefer this method as it is the simplest.

There are many reasons why it is safer for the patient, when exploring a pleural cavity in which there are no adhesions to use some form of positive pressure anaesthesia. When a normal pleural cavity is opened wide (that is, the opening is large enough to permit the surgeon thoroughly to explore it) if no form of differential pressure anaesthesia is used the lung collapsing may reduce the respiratory area too quickly and also there may be a fluttering of the mediastinum. In this, the contents of the mediastinum flap back and forth without support, and this causes a deleterious effect on the heart great vessels, and nerves, and may even produce asphyxia. When it is necessary to suture the lung to the chest wall, if it is in a collapsed state it is difficult to place sutures and bring the lung to the chest wall without tearing it whereas, if it is held satisfactorily in full expansion, by differential pressure anaesthesia, this is a very simple procedure.

No definite rules can be formulated as to operation. If there is very little sputum one or two ounces in 24 hours, and the sputum is not foul if there is no evidence of sepsis immediate operation is not advisable. On the other hand if the sputum is very foul large in amount, and marked sepsis is present operation should be performed. Abscesses which are situated in the periphery of the lung and in which the X ray demonstrates a fluid level are more favorable for operation than those situated deeply about the root of the lung. If there is no improvement in 4 to 5 weeks, or if at any time, the patient's condition becomes

worse, operation should be strongly considered. In delaying operation too long it should be remembered there is always the danger of brain abscess, meningitis, septicaemia, extension of the process in the lung and fatal hemorrhage. The more chronic a case becomes, the more difficult it is to cure as the abscess wall becomes thicker and firmer through fibrous tissue formation.

It is necessary to locate the abscess at the first operation. We know that in most cases the lung and costal pleura will be adherent and that this will take place in the region nearest to the abscess. Therefore it is this region that the surgeon should try to find and having found it should drain the abscess through it. If the lung and costal pleura are not adherent they should be made so before opening the abscess. The correct approach to the abscess having been determined as accurately as possible by means of X-ray and physical examination under local anaesthesia a window in the chest wall is opened down to the pleura. Sections of one or two ribs should be removed, and the pleura should be carefully inspected. If the lung and pleura are adherent and this exposed region is near the abscess the pleura will look and feel thickened. It will have a grayish white color feel firm rather than soft as a normal pleura feels and the lung will not be seen moving with respiration. If this condition is found the lung may be immediately opened and the abscess cavity found and drained. On the other hand, if the lung and pleura are not adherent the lung will be seen moving up and down with respiration beneath the pleura and the pleura itself will appear and feel normal. Then further search should be made for the adherent area by a resection of one or more ribs. If this area is finally found the abscess should be immediately opened through it. It may be impossible to find an adherent area. Then, under positive pressure anaesthesia, the pleural cavity should be opened widely and the lung palpated for the abscess. This region may be easily differentiated from normal lung by the sense of touch. It will appear as a localized hard indurated area and obviously very different from the soft, spongy normal lung. This area should then be brought up to the chest wall

and sutured there. If there are no adhesions about the other lobe of the lung so that it would collapse without positive pressure anesthesia, it too should be sutured to the chest wall. A gauze sponge should be placed against the abscess area and the wound closed. Three to five days later under local anesthesia, the wound is again opened. (If the abscess should be opened at the first operation, in spite of suturing the lung to the chest wall and packing the area with gauze in at least 50 per cent of the cases there will be a leakage through the suture so that an empyema will result.) At this second stage the newly formed adhesions will have securely walled off the whole pleural cavity from the abscess area. This may now be considered extra-pleural. The abscess at this stage should be opened and drained. An incision is made into the lung and the abscess broken into with the finger. In this way the finger will tend to push to one side any blood vessel that it may meet whereas, if the abscess is opened with a cautery it will cut through the blood vessel and seal it over so that there will be no immediate bleeding, but when sloughing takes place a few days later there may be a secondary hemorrhage. The abscess should be drained with a very soft rubber tube. (Gauze wicks prevent good drainage and the patients are very uncomfortable as the abscess must still be drained by coughing and raising until the gauze is removed.)

Acute abscesses must be drained for 4 or 5 weeks or possibly a little longer. In the chronic cases it is necessary to continue drainage for a much longer time than in the acute cases. Drainage for 3 to 4 months, 6 months or even longer may be necessary.

#### RESULTS OF SURGICAL TREATMENT

Taffier in 1897 (9) reported 23 cases with a mortality of 26 and 74 per cent cured. Murphy (7) in 1898 reported 96 cases with a mortality of 39 and 61 per cent cured. Garre (1) in 1912 reported 182 cases with a mortality of 28.6 per cent. Hedblom (2) in 1919 reported 54 cases with a mortality of 23 per cent. Lockwood (4) in 1922 reported 27 cases with a mortality of 41 per cent. In 1915 I reported 27 cases with a mortality of 25 per cent. In 1921

21 cases with a mortality of 16 per cent and in 1923 52 cases with a mortality of 15 per cent (11).

From these figures it may be assumed that the mortality will vary from 15 to 35 per cent. This may be accounted for in various ways, one of which is that the kinds of cases presented for operation will vary greatly. When the abscess is situated in the periphery of the lung and this is adherent to the costal pleura with an easy approach the result of operation will be better than when the abscess is situated deeply in the lung and this is not adherent to the costal pleura. Other factors, such as age, condition of the patient, etc. must enter into the ultimate result.

From 60 to 70 per cent of the cases operated upon may be expected to be cured or permanently improved. In a few of the long standing chronic cases it may be necessary to establish a permanent fistula, and it is these that are classified as permanently improved. They can lead a useful life but cannot enjoy swimming or take violent exercise. There is a small group of about 5 per cent of the cases that leave the hospital in excellent condition having made a good recovery following operation. These do well for a few months and then begin to have more cough and expectoration. Soon after this they begin to have small hemorrhages which gradually increase in amount until the patient finally dies during a severe hemorrhage.

#### CONCLUSIONS

1. It is important for the surgeon performing operations on the upper respiratory tract under general anesthesia to bear in mind the danger of lung infection and arrange his technique so as to avoid this complication.

2. From 10 to 30 per cent of the cases may be expected to be cured by expectant treatment.

3. Artificial pneumothorax may cure a very small number of cases. It should be used only in those cases in which the lung and costal pleura are not adherent. It is an excellent means of determining whether or not adhesions are present.

4. Bronchoscopy may cure a very limited number of cases if treatment is established early.

5 Surgery offers an excellent chance for cure in those cases in which other methods of treatment have failed or are unsuitable

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PRINCIPLES INVOLVED IN THE TREATMENT OF ACUTE AND CHRONIC EMPYEMA<sup>1</sup>

B. EVARTS A. GRAHAM, M.D., F.A.C.S., St. Louis

From the Department of Surgery, Washington University School of Medicine, St. Louis

**A**SUBJECT so extensive as the one assigned to me cannot be discussed in the limited time of twelve minutes. It can only be outlined. Mention, therefore, can be made of only the salient points.

In acute empyema the most important object of treatment is to save life. But this must not be the sole object. It is also important to prevent chronicity. Fortunately the type of treatment which is most effective in saving life is also the one which usually reduces to a minimum the possibility of chronicity. The three most important principles in the treatment of acute empyema are: (1) the avoidance of open drainage during the stage of acute pneumonia to be followed in nearly all cases by free drainage at a suitable time; (2) irrigation of the cavity; and (3) maintenance of the nutrition of the patient.

The experience of the United States Army in the war clearly demonstrated the effectiveness of the principle of the avoidance of an open drainage during the stage of acute pneumonia. At Camp Lee the Empyema Commission saw the mortality drop from more than 40 per cent to less than 5 per cent when this principle was carried out. Similar striking reductions were also noted elsewhere. In civil practice, since the war, equally remarkable mortality figures have been obtained when adherence has been made to this principle. At the St. Louis Children's Hospital, since September 1919, we have treated 86 cases of acute empyema by a plan of repeated aspirations during the pneumonic stage followed by free drainage. In this series there have been ten deaths, but not a single case has been fatal which was not accompanied by serious complications, such as suppurative mastoiditis or meningitis. This mortality of 11 per cent compares very favorably with the high mortality which we formerly expected to have with children. 54 per cent for example as reported by Holt.

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In 1913. It seems to make no practical difference in results whether a plan of repeated aspirations or one of continuous closed drainage is used during the stage of acute pneumonia. There is no particular magic in any code of details. The important matter is not to create an open pneumothorax while a pneumonia exists. In the pneumococcal type of empyema, there is less likelihood of committing this mistake because usually by the time empyema is recognized the pneumonia has subsided. In the streptococcal type, however, the empyema is usually coincident with the pneumonia. The principle of treating empyema by aspiration or continuous closed drainage is an old one which has been repeatedly rediscovered. Hewett,<sup>2</sup> in 1876, and Buelau<sup>3</sup> in 1891 both described excellent methods. Diedrich<sup>4</sup> was one of the first to introduce it into army work. A rational explanation of why an open pneumothorax should be avoided during the stage of pneumonia was first supplied by R. D. Bell and the writer<sup>5</sup> while members of the Empyema Commission. Briefly the explanation lies in the fact that when the vital capacity<sup>6</sup> is low a small opening in the pleura is more likely to induce a fatal asphyxia than when the vital capacity is high. In pneumonia, the vital capacity is often so low that it practically equals the tidal air requirements. In such a case an opening of any size is likely to be followed by a fatal asphyxia. These conclusions do not hold good if adhesions are present or if the mediastinum has been made rigid by

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<sup>6</sup>The term vital capacity as used in this article means the maximum amount of air that can be expired after a maximum inspiration. It can be used by measured with a spirometer. It physiologically the term means that very definite significance.



Fig. Roentgenogram of case of acute empyema seen in March, 1920



Fig. The same patient after open drainage had been instituted. The pus obtained showed pure culture of hemolytic streptococcus

induration. When the open drainage is carried out after the subsidence of the pneumonia, not only has the vital capacity by that time increased to such an extent that a small pleural opening is no longer likely to induce a fatal asphyxia, but there are also usually adhesions present which minimize still more this danger.

If this plan is carried out it will be found that about 10 or 15 per cent of the cases will require no later operation for drainage. Some times after one or two aspirations no further exudate will be formed. If however the exudate persists the most convenient criterion of when to institute open drainage is the character of the exudate. This should be definitely and moderately thick pus before creating open drainage. Certainly serous and serofibrinous exudates should not be drained openly. The object should be to create an abscess and then drain it, just as in other acute surgical inflammations. Much harm results from the drainage of serous exudates not only in pyogenic infections but also in tuberculosis. When drainage has been de-



Fig. 3. The same patient 4 days after drainage. Not how rapidly the lung has come out to meet the chest wall to obliterate the cavity. At this time the patient left the hospital without permission and removed drainage tube.





Fig. 4. The same patient 3 1/4 years later than shown in roentgenograms, Figures 2, and 3. When he returned with large recurrence of pyopneumothorax. On readmission he stated that within one or two weeks after taking out his ribs the wound healed over and he remained perfectly well for about 3 years, during which time he engaged in heavy manual labor. In spite of the absence of symptoms it is clear that his empyema was not healed, because the cavity was not obliterated. A follow up letter to him would have received undoubtedly favorable answer. This clearly emphasizes the importance of having the cavity obliterated before one can be sure that a case of empyema is healed.

cided upon. It should be adequate and not a compromise. Our own opinion is in favor of the subperiosteal resection of a portion of rib although there are many who prefer an initial trial of drainage through an intercostal space. The operation can usually be done satisfactorily with local anesthesia but with apprehensive children I believe nitrous oxide and oxygen are preferable. The site of the drainage should obviously be at the most dependent portion of the cavity. Ordinarily the removal of a segment of the eighth or ninth rib in the posterior axillary line will prove to be satisfactory. At the time of the rib resection we inject the corresponding intercostal nerve as well as the one immediately above and below with 95 per cent alcohol a suggestion which I think was first



Fig. 5. The same case after drainage 3 1/4 years after his first drainage. The cavity is now clearly much larger than it was originally and the patient therefore in worse condition than at the time of the first operation. He also had a large bronchial fistula leading into the pleural cavity.

made by Davies. This procedure, by paralyzing the nerves, eliminates much of the postoperative pain. For the past two years we have also been rubbing sterile bone wax into the open cut ends of the ribs before the pleura is opened in order to minimize the creation of an osteomyelitis of the rib.

Irrigation of the cavity is effective in hastening the healing. For this purpose I do not know of any better solution than the sodium hypochlorite solution proposed by Dakin. Its value seems to be not so much in its direct bactericidal power as in the fact that by rapidly removing masses of fibrin and necrotic tissue which coat the lung and also lie free in the pleural cavity sterility is usually rapidly accomplished because the large number of bacteria which are embedded in this tissue are rapidly removed. Also the early removal of this thick layer of fibrin



Fig. 6 One convenient method of obliterating relatively small cavities is by turning in pedicle flap of skin and subcutaneous tissue into the cavity as shown in this drawing. The pedicle of the flap after 3 or 4 weeks is cut across.



Fig. 7 For obliterating the cavities which extend into the apex, a convenient method is to dissect up the latissimus dorsi muscle from its bed, leaving it attached by its tendon of insertion and turning the entire body of the muscle into the cavity.

from the visceral pleura by the Dakin's solution seems to permit a more rapid expansion of the lung than is otherwise possible. In cases in which a direct communication with the lung (a bronchial fistula) exists, caution is necessary in carrying out the irrigations, and in some cases it will be necessary to postpone the irrigations until this communication has healed. Usually the small pulmonary fistulae will be healed in a few days if the irrigations are withheld.

The maintenance of the nutrition of the patient is of the utmost importance. Forced feeding with a high caloric diet should be the rule. Accurate knowledge of whether the patient is gaining should be obtained by weighing at regular intervals. In the average adult the gain should be from 2 to 5 pounds per week during the first few weeks after establishing drainage. Other important hygienic measures are a liberal allowance of fresh air and behavior therapy. At St. Louis we follow a scheme very similar to that suggested by Rollier<sup>1</sup> for tuberculous modified

by the use of a quartz lamp in the winter time as a substitute for the sun's rays.

When is an empyema healed? The answer is: Not until the cavity is both sterilized and obliterated. Not until then can the patient be assured that he will not have a recurrence. It cannot be too strongly emphasized that the mere healing over of the drainage opening is no indication that the empyema is healed. I have known patients to consider themselves well and even to be able to engage in heavy manual labor for years after the drainage opening has healed only to have a recurrence later. In one case (see Figs. 1 to 5) a man was engaged in heavy manual labor for 3 years after his draining opening had healed and then gave evidence of a recurrence at the second operation he had 1000 cubic centimeters of pus in his chest. It is for this reason that I can not agree with those who advocate the closure of an empyema, regardless of the remaining cavity even if successive cultures

from it have shown no growth. It seems to me that many of these cases will certainly develop a recurrence. Artificial aids to the spontaneous obliteration of the cavity are blowing exercises and general exercises. The progress in obliteration should be noted by measuring the capacity of the cavity at regular intervals. Blowing into a spirometer is an excellent exercise because the patient can watch his gain in vital capacity in that way.

Bronchial fistule should not be closed artificially during an acute suppurative process. They frequently act as safety valves for suppuration within the lung and when their need has ceased they nearly always close spontaneously. Several months should be allowed to elapse before artificial closure of them is attempted.

Chronic empyema should be regarded as a preventable disease. The majority of cases which one sees have been due to causes which may be regarded as preventable. The most common causes are inadequate drainage, too late drainage, too early drainage and the presence of foreign bodies including sequestra from ribs. Certain cases, however, are due to a failure of the cavity to become obliterated because of an unavoidable extensive fibrosis and contraction of the lung; others are due to tuberculosis, about 13 per cent, in my own experience. Since the majority of cases are due to improper drainage and foreign bodies, it is well to begin the treatment conservatively by establishing adequate drainage at a proper site and at the same time searching

for a foreign body in the cavity. A combination of proper drainage and irrigation for a few weeks will often produce marvelous results in these cases. Hedberg has published an interesting compilation of cases of chronic empyema treated conservatively showing the remarkable results which may be obtained in the obliteration of the cavities in this way. My own experience has been similar. A careful search for tuberculosis should also be made. Microscopic examination of an excised piece of thickened pleura will not establish the diagnosis when other methods fail.

If a trial of good conservative methods for several weeks or months has failed to produce healing, then various plastic procedures may be instituted. There will be less danger in performing them at this time because the field will have been made much cleaner. The principles involved in these plastic operations are designed to obliterate the cavity and they are in general of three kinds: (1) encouraging the lung to expand to meet the chest wall by loosening adhesions, decortication, etc.; (2) making the soft parts of the chest wall meet the lung by removal of ribs and thickened parietal pleura, and (3) filling the cavity with living tissue such as a muscle flap or a skin flap. The use of pastes of various kinds to plug the cavity is objectionable because frequently the paste passes into the lung and becomes widely disseminated throughout the bronchial tree.

Hedberg, C. A. The treatment of chronic empyema. Ann. Surg. 1920, 71: 685.

SURGERY OF THE THORAX<sup>1</sup>

B. DALLAS B. PHEMISTER, M.D. F.A.C.S. CHICAGO

I WANT to limit my remarks to what brings about expansion of a collapsed lung in acute empyema with drainage where stabilization of mediastinum has occurred. This may be the result of three factors:

1. The pull of the contracting granulations on the visceral pleura at its reflection on to parietal pleura as the two layers fuse and the cavity is gradually obliterated.

2. The positive pressure within the collapsed lung produced by the entrance of air from the opposite side during forced expiration.

3. The negative pressure in the empyema cavity present during inspiration when the diameter of the drainage opening is smaller than that of the main bronchus on the affected side.

Of the three factors, the pulling out of the lung by the healing granulations is the one of greatest importance. With the establishment of suitable conditions, the empyema wound heals and the cavity is obliterated by granulation tissue and the fusion of its walls.

In acute empyema, there is variation from the ordinary wound with a cavity in that one half of its wall is fixed and the other half has to be brought to it. The parietal wall of the cavity is rigid so that obliteration is accomplished by bringing the visceral wall out in contact with it. Granulation tissue along the line of junction of parietal and visceral pleura gradually leads to fusion of the two surfaces and this proceeds toward the drainage opening until the visceral pleura and lung are pulled out and the cavity is obliterated. This is assisted by positive pressure within the lung during forced expiration. If conditions for wound healing are satisfactory expansion will occur even when the drainage opening in the chest wall is larger than the bronchus on the affected side so that negative pressure in the pleural cavity is not produced during inspiration. It will also occur then without any special means being taken to increase the positive pressure in the collapsed

lung during expiration by forced measures, such as blowing exercises.

To create the most favorable conditions for wound healing and consequently for cavity obliteration, general surgical principles of wound healing should receive first consideration and the special principles applicable to the chest because of pressure conditions, while employed should receive secondary consideration. Free drainage at the most dependent point is the important factor. The drainage tube should be large, particularly when large deposits of fibrin are present. The tube reaching just beyond the chest wall into the cavity should be left in until the cavity is completely obliterated. Chronic empyema almost never results from too large a tube or from leaving in a tube of proper length too long, whereas it is not infrequently the result of too small a tube or of drainage for too short a time. Free drainage does the most toward procuring healthy granulations on the pleural surfaces. Healthy granulations lead to fusion of parietal and visceral pleura and obliteration of the cavity. Unhealthy granulations lead to failure of fusion of the two surfaces and to the formation of thickened pleura, which retard lung expansion and tend toward chronic empyema. I doubt very much if anything is accomplished by irrigation of the pleural cavity in acute empyema, except in those cases where there are large amounts of fibrin or in the very exceptional cases where sloughs are present, and then the irrigations do not need to be continued beyond the time of their removal. Fibrin is not nearly as harmful in empyema as some have imagined. It is readily digested by proteolytic ferments liberated by the pus cells and its presence is an indication either that leucocytes are being poured out in relatively small numbers or that the antiferment content of the exudate is high. Either condition is in general a favorable sign. The special objection to fibrin on the pleura is that, if present during the healing stage, it is partly replaced by granulations, which thicken the pleura.

## SEVENTEEN LIFE-SAVING BRONCHOSCOPIES IN ONE CASE

By LOUIS H. CLERF, M.D., PHILADELPHIA.

The Bronchoscopic Clinic of Jefferson Hospital.

STATISTICS of various hospitals show a mortality ranging from 10 to 20 per cent, and curiously this high death rate is attributed to post-tracheotomy pneumonia and in some instances to edema of the lungs. In some institutions there was a high operative mortality. At the Bronchoscopic Clinic we have had no operative mortality and our postoperative mortality is not over 1 per cent. Postoperative lobar pneumonia has been conspicuous by its absence. Our freedom from operative mortality may be due to the fact that we never use general anesthesia for tracheotomy. We believe that in dyspneic cases its use is attended with very high mortality. Our low postoperative mortality we believe, however, is not due so much to the difference in technique of the tracheotomy as to the use of the bronchoscope and of the aspirating tube in the after-care. We are convinced that the supposed pneumonia seen elsewhere is, in most cases, an error in diagnosis. Over and over again we have seen most of the signs and symptoms of pneumonia present

in a case and have seen them disappear in a few minutes after removal of obstructing secretions from the bronchi.

The fundamental mechanics of a tracheotomy are these: With the insertion of a tracheotomy tube into the trachea a new airway is established and the larynx which is the most common seat of obstruction to the normal air current, has been eliminated. In order to maintain its effectiveness, the newly created airway and the tracheobronchial tree beyond this point must be kept open. This requires the attention of a surgical plumber whose chief duty is to keep open the air pipes, natural and artificial.

How a realization of these fundamental mechanics can eliminate the symptoms and signs often wrongly interpreted as post-tracheotomy pneumonia is shown by the following report of a case which, though extreme, is one of many similar cases.

Case V. Fbd. 90 Girl, 16, was admitted to the Bronchoscopic Clinic with history of choking while eating peanuts on the day previous. A beating on expiration had developed immediately.

On admission the temperature was 100.4 degrees F. A distinct asthmatic wheeze could be heard during expiration. There was moderate dyspnea. Physical signs indicated obstruction to the middle and lower lobes right lung. D. W. F. Mangles, by roentgen ray examination, localized non-opaque foreign body in the right 4th bronchus. Bronchoscopy by Dr. Chevalier J. Clifton on the day of admission showed peritubercle in the right bronchus which was removed about anesthesia general or local in minute 5 second. Marked clearing of the subglottic tissues was noted at this time.

Dyspnea became progressively more and tracheotomy was done under local anesthesia (apocaine 15 per cent) about 5 hours after bronchoscopy. After operation of considerable quantity of thick tenacious pus from the trachea. A cannula was inserted. It was noted at this time that the patient made no effort to find the trachea of blood or secretion by coughing. Instead he fell asleep as soon as the trachea was opened. An anesthetic had been injected into the trachea to obtund the cough reflex and need not be given to interfere with the cough dog.



1119

Fig. These represent all the crusts removed during the seventeen bronchoscopies. Some of them are of such great size to obstruct large bronchi completely. The signs of the so-called pneumonia cleared up immediately upon removal of the encrusting mass of secretions.

TABLE I

Time	Physical Signs	Procedures	Results
Jan. 27 1952 10:00 AM	Marked diminution of breath sounds over right lower lobe and entire left lung	Removal of crust from bifurcation and aspiration of secretion	Free secretion of both lungs
Jan. 27 1952 10:00 AM	Partial obstruction lower lobe left lung and middle and lower lobes right lung	Removal of crusts from right bronchus and aspiration of pus from left bronchus	Airway re-established
Jan. 27 1952 11:25 AM	Marked air hunger, pallor, restlessness. No air entrance entire left lung. Partial air entrance right low lobes	Removal of large crust from left main bronchus. Aspiration of pus from both bronchi	Symptoms did not clear up completely. Right lower lobe cleared. Some obstruction to left lung persisting
Jan. 28 1952 09:30 AM	Progressive increase of signs of air hunger. Left lower completely cleared off. Some interference with right low lobes	Removal of crust from left bronchus. Large amount of secretion aspirated from both bronchi	Marked improvement of signs and symptoms. Full entry immediately. Excellent secretion of both lungs
Jan. 28 1952 09:00 AM	Recurrence of dyspnea. Marked obstruction to left lung and to middle and lower lobes right lung	Removal of large crust at carina. Aspiration of secretion	Free secretion of left lung and of middle lobe. Lower right still obstructed
Jan. 28 1952 10:30 AM	Marked dyspnea. Back came on suddenly. Before bronchoscopy could be introduced patient became cyanotic, then respiration ceased	Large crust removed from trachea at carina. Considerable secretion aspirated	Breathing re-established by artificial respiration. Airway to both lungs opened
Jan. 28 1952 11:00 AM	Obstruction to left lung and lower right lobe	Secretion aspirated and crust removed from right bronchus	Free secretion of both sides
Jan. 28 1952 11:00 AM	Entire right lung seems obstructed. Left side clear	Small crust of secretion removed from right bronchus	Obstruction of air current to right lung partially relieved
Jan. 28 1952 11:00 AM	Aspiration of both lungs achieved. Marked dyspnea. Airway pallor	Large amount of secretion with small fragments of crust removed from both bronchi	Some improvement in physical signs
Jan. 28 1952 11:00 AM	Marked obstruction to entire left lung. Partial obstruction to right lower lobe	Hard, dry crust removed from left bronchus. Secretion from right bronchus	Free secretion of both lungs
Jan. 28 1952 11:00 AM	Obstruction to both lower lobes. Mucus smeared over the right	Dry crust removed from right bronchus. Secretion aspirated from both sides	Marked relief. Spont. full, partial right
Jan. 28 1952 11:00 AM	Considerable interference left lower lobe and right low lobes	Small crusts removed from both main bronchi	Marked improvement on both lungs
Jan. 28 1952 11:00 AM	No air entering the left lung. Air some obstruction to right lower lobe	Large crust removed from left bronchus, considerable secretion aspirated from both sides	Breath sounds heard very well over both lungs
Jan. 28 1952 11:45 PM	Entire left lung and lower right obstructed	Small crust and secretion removed from both sides	Free secretion of both lungs
Jan. 28 1952 11:45 PM	The entire left lung seems to be out of communication	Large crust removed from left bronchus at carina	Marked relief. Air improvement of signs over left chest
Jan. 28 1952 11:45 PM	Some obstruction to entire left lung and right lower lobe	Aspiration of large amount secretion with removal of many small crusts	Obstruction cleared up. Return of slight cough reflex
Jan. 28 1952 01:00 AM	Left bronchus seems completely blocked. The right side clear	Aspiration of large amount secretion from left main bronchus	Left lung clear. Cough reflex more active

A 30 cc. suction bulb was used and no anesthetic was given in the 17 bronchoscopies listed in this table.

Everything went all for about 36 hours when the urine long experienced in tracheotomy. We noticed that the child was restless, that the respiratory rate had increased and that there was beginning dyspnea. The inner cannula was changed with no apparent relief. The child made no attempt to cough or could the reflex be provoked. Dr. Holman, the intern in charge of the case, changed the tracheotomy tube. A relief being obtained he concluded that there was obstruction of the airway beyond the end of the tube and devised bronchoscopy. On examination I found moderate limitation of expansion, slight impairment of resonance and marked diminution of breath sounds over the entire left lung and the right lower lobe. A tracheostomic bronchoscopy as done which showed swollen bronchial mucosa with thick crusted secretion, particles of blood were removed with forceps. After the bronchoscope was withdrawn a crust representing a partial cast of bronchus, as coughed up. Breathing

was greatly relieved and breath sounds could be well heard over the entire chest.

In all, seventeen bronchoscopies were done within 104 hours as noted in Table I. Each was believed indicated because of the progressive development of dyspnea with moderate indrawing, increased respiratory and pulse rates, pallor and restlessness. At no time was there cyanosis. In addition examination of the chest revealed one or more lobes, even an entire lung to be partially or completely out of function.

Every effort was made to find the trachea of secretion in order to avoid further bronchoscopies because it was feared that frequent bronchoscopy, although relieving the obstruction, would exhaust the child.

The tracheostomy tube was changed at very frequent intervals and flexible aspirating tube was introduced into the trachea to remove secretions. A

croup tent with medicated vapor was used. Professor Hare was consulted, with a view of giving internal medication to promote a more copious flow of the bronchial secretion and to stimulate the cough reflex.

With the gradual return of the laryngeal reflex and a more profuse bronchial secretion, aspiration of the upper trachea through the tracheotomy wound every 2 hours was sufficient to relieve the patient and further bronchoscopy was unnecessary. The two hour interval was gradually lengthened and aspiration was discontinued 3 days after the last bronchoscopy when the patient was again able to rid the air passages of secretion by spontaneous coughing.

Decannulation preceded by coughing was done about 3 weeks, and the patient was discharged apparently with no evidence of pathology in the chest.

In a review of many of the leading present day textbooks on surgery and laryngology one still sees frequent reference made to pneumonia as a complication of tracheotomy.

With the clinical picture of limited expansion, impaired resonance and diminished or suppressed breath sounds over one or more lobes and many rales over the entire chest associated with rapid pulse and respiratory rate and fever the diagnosis of pneumonia seems justifiable. Unlike pneumonia however in the case reported these signs were discontinued by bronchoscopic removal of cruds and secretion, and the child previously restless slept peacefully until there was a recurrence of the obstruction to the airway sufficient to produce a repetition of the signs and symptoms of air hunger.

Dr. Jackson states that pneumonia is one of the rarest of complications following tracheotomy.

#### CONCLUSIONS

1. Tracheotomy is a means toward an end. It does not insure a permanently free airway.
2. Close observation and watchful after care of every tracheotomized patient is imperative.
3. An increased respiratory rate with signs of dyspnea rarely mean pulmonary complications and almost never lobar pneumonia.
4. The most common cause of post tracheotomy dyspnea is mechanical obstruction to the airway. This may be due to secretion, to an improperly fitting cannula or a cannula which has not been properly placed.
5. Any case of dyspnea not relieved by changing a properly fitted, clean cannula should have a bronchoscopy done to see why the air is not getting down into the lungs.
6. Obstructive dyspnea is impossible when the tracheotomy tube and the tracheobronchial tree are patulous.
7. A bronchoscope and a mechanical aspirator should be at the bedside of every tracheotomy case. These may be the means of saving life in any case.
8. In the cases of total absence of the cough reflex often seen in children after tracheotomy the patients will all die unless the secretions are removed mechanically.

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1901.

## PAPILLOMATA INVOLVING THE FEMALE URETHRA

BY HENRY A. R. KREUTZMANN, M.D. SAN FRANCISCO, CALIFORNIA

VERY little mention has been made of true papillomatous growths of the female urethra without involvement of any other part of the urinary tract. During the past 2 years however innumerable such cases have come to my attention, and I have found that the growths are most common in patients suffering from a chronic infection of the urinary tract.

That the female urethra in the past was considered a relatively unimportant structure no doubt accounts for the fact that more frequent and thorough urethroscopic examinations with water-dilating cystoscopes have not been made, and the result has been that this condition is often overlooked.

## LITERATURE

Many references are found in the literature to polypi and papillomata of the female urethra. Most of them however refer to the caruncle which occurs at the meatus and is not classified as a true papilloma.

In the days before cystoscopy only when the growths had attained sufficient size to protrude from the urethra and had become visible to the eye were they noted.

Bullock (1) in 1893 described a case in which the tumor protruded from the vulva. It was attached to the posterior half of the meatus urinarius. It was 2 centimeters in length lobulated, dry elastic, and painless. He stated that the patient refused to have it removed fearing that she might not be able to pursue her vocation as washerwoman.

Desguin (2) reported a case of a girl of 17 who had a growth protruding from the vulva which resembled an inverted uterus. The growth was fastened to the right side of the urethra. The urethra itself was so greatly dilated that digital examination was possible. A second growth was palpated higher up on the left side of the urethra near the bladder neck. The patient also had complete incontinence. The growths were removed with a wire snare.

Luyts, in his book on *Cystoscopy and Urethroscopy* (3) states that at times one finds well developed polypi in the urethra of the female. He divides the urethra into two distinct anatomic parts: the posterior part which adjoins the neck of the bladder and is entirely muscular in structure and the anterior part which contains an abundance of glandular orifices. Luyts believes that the existence of these glands is probably responsible for the tendency of the gonococcal infection to persist in the female urethra; they may also account for the frequent development of polypi at the external orifice of the urethra.

Pederson (4) states that fibrous polypi are by no means uncommon in the female urethra and may enlarge elongate their pedicles and by muscular action present at the meatus exactly as does a uterine polyp at the external os.

## SYMPTOMS

This paper is based on 40 cases in which multiple papillomata were demonstrated in the urethra with no associated growths elsewhere in the urinary tract. As yet we have never met with a case in which a papilloma was seen protruding from the meatus. Contrary to the statement of Luyts, the growths observed in this series of patients occurred in the posterior urethra.

As most of the patients in whom this condition was found had other lesions of the urinary system it is difficult to say whether or not their symptoms were due to the papillomata or to the co-existing pathology.

Although these growths may attain considerable size, only one patient of the entire number complained of any symptoms amenable to that of obstruction. The most common complaints in the order of frequency were frequent urination nocturia dysuria, urgency and hesitancy.

Only 50 per cent of the cases showed pus cells in the catheterized specimens of bladder urine. The same number gave positive cul-



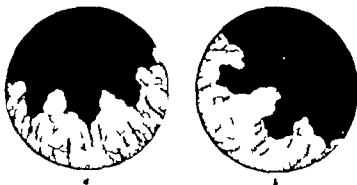


Fig. Papillomas as seen through the Buerger urethroscope. Note the position of the growths on top of the folds of mucous membrane.

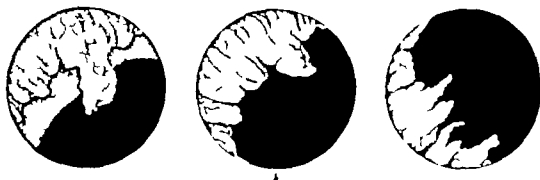


Fig. Papilloma as seen with Buerger posterior cystoscope. A large villous growth is shown with part of the bladder neck beyond.

tures. *Bacillus coli* was the most common organism found.

In 43 per cent of the cases there was a history of previous cystitis which in some patients had lasted for many years and in others had recurred intermittently up to the time of examination.

#### DIAGNOSIS

This cannot be made from the symptoms, but only by direct examination. In the entire series there was no case in which any growths were visible at the meatus. It was only after careful search of the urethra that the papillomata were found.

The best instruments to use are water dilating cystoscopes equipped with a lens system, such as the posterior Buerger or McCarthy cystoscopes or the Buerger or Genger urethrosopes.

The growths were found to be most frequent on the anterior and lateral walls of the posterior urethra just outside of the vesical sphincter. They were so close to the bladder that by moving the eyepiece of the cystoscope to the extreme right or left side of the patient the papillomata projected into the urethra and were plainly visible against the dark background of the bladder.

The growths were not sessile but were villous in shape, whitish to pink in color with a fine blood vessel along the periphery.

They varied in number from two or three to cases in which the entire wall was covered. They did not extend along the entire urethra, but seemed to be limited to a distinct zone beginning just external to the vesical sphincter and extending for approximately half a centimeter toward the anterior urethra.



Fig 3 Photomicrograph of single papilloma, under low power

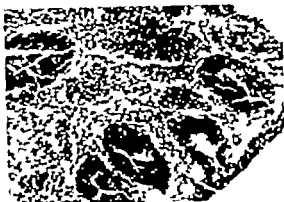


Fig 4 Section of growth under high power

The picture obtained with a cystoscope is quite different from that seen with a urethroscope. With the cystoscope the lens is close to the growths flattening them out. As their color is similar to that of the surrounding mucosa it is sometimes difficult to see them except by moving the outer end of the instrument sharply to one side so as to make an acute angle with the wall of the urethra. With the urethroscope the mucosa appears striated with the lines running parallel with the instrument a picture similar to that seen in that part of the male urethra lying between the internal sphincter and the verumontanum. The papillomata now appear as fingerlike projections pushing from the sides toward the lumen of the canal. It is then observed that they originate from the crests of the rugae and it is sometimes difficult to distinguish them from the heaped up mucosa on the tops of the ridges.

#### TREATMENT

After anesthetizing the urethra the larger growths were removed with the cystoscopic rongeur and their bases fulgurated.

In cases in which multiple small growths occurred, the high frequency current alone was used. It was necessary to be careful not to burn too deeply in order to prevent a large slough with subsequent scar tissue formation.

The patients returned after 6 to 8 weeks. If a second examination showed any remaining growths the high frequency current was again applied.

#### PATHOLOGY

In a number of cases in which the growths were removed with the rongeur sections were

made and examined microscopically. The pathological report was made by Dr W T Cummins pathologist at the Southern Pacific Hospital. The findings in the various cases were very much the same. The following is a characteristic picture of the pathology present.

Mrs J C No 79362 There is an irregular thickening of the epithelial margin while the underlying tissues are made up in the major part of a dense round cell infiltrate and some mucous tissue with plasma cells. There are a few small pearls near the margin of the tissue. Epithelial mitotic figures are not conspicuous. Blood vessels are few in number congested and their walls are thin. There are scattered areas of hemorrhagic infiltration.

#### DISCUSSION

After having observed a large number of women in whom papillomata were present, the conclusion is reached that the growths themselves cause few if any symptoms. Their importance lies in the fact that when they are present some pathological condition is to be found somewhere in the urinary system. They are a signpost pointing to trouble somewhere along the line.

In the forty cases under review 87.5 per cent showed urinary pathology as follows:

	Per cent
Cystitis (including pyelitis 7%)	50
Stricture of the ureter	15
Stricture of the urethra	8
Gonorrhoea (chronic)	5
Renal calculi	7

In the remaining 12.5 per cent of cases we believe either that the diagnosis was missed or that the condition causing the formation of the papillomata had been removed before the patient came for examination.

These growths are the result of a long continued irritation to the mucosa usually bacterial in origin. Therefore one may expect to find that the lesion present is due to some organism invading the urinary tract. However that does not mean that every case of urinary infection shows the presence of papillomata in the urethra.

It is only in the chronically infected cases that one may expect to find these growths. We have noted that so far in none of the cases of kidney and bladder tuberculosis diagnosed during the past 2 years has this condition been present.

# CONCLUSIONS

Papillomata are quite common in the female urethra.

They occur most often in the posterior portion, just external to the vesical sphincter.

They are the result of a chronic inflammation of some part of the urinary tract.

In themselves they cause few symptoms. Their importance lies in the fact that when present, they are indicative of long standing pathology somewhere in the urinary system.

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## LYMPH GLANDS IN CARCINOMA OF THE SMALL INTESTINES

A REVIEW OF THE CONDITION OF THE GLANDS IN CARCINOMA OF THE GASTRO-INTESTINAL TRACT

BY WINCHELL MCK CRAIG M.D. ROCHESTER, MINNESOTA

Fellow in Surgery Mayo Foundation

THE incidence and degree of metastatic involvement of regional lymphatics in cases of carcinoma has long been recognized as an index to the extensiveness of the lesion as well as an aid in prognostication. Anatomists, embryologists, and physiologists have shown that the gastro-intestinal tract has a definite and well-organized lymphatic drainage following certain anatomic lines and having definite terminations. Intensive studies of series of cases of carcinoma have been undertaken because of the dissemination of carcinoma through the lymphatic system, and the regional lymph glands, the point of initial metastasis.

## RELATIVE INCIDENCE OF THE DISEASE

Carcinoma of the small intestine is rare and the symptoms of stenosis lead to the recognition of the disease. Combining the statistics of Maydl, Nothnagel, Zerman, Mueller and Bryant it is seen that of 659 cases of intestinal carcinoma that have been collected the carcinoma was in the small intestine in 6.22 per cent. The statistics of Maydl, Nothnagel, and Mueller show that of the twenty-six cases of carcinoma of the small intestine, the carcinoma was in the duodenum in thirteen and the remaining thirteen were in the ileum and jejunum. Other statistics indicate that a greater majority of the lesions are located in the duodenum. Rolleston has collected fifty-four cases of primary carcinoma of the intestines, and only nineteen were in the ileum and jejunum.

In 1919 Judd reported twenty-four cases of primary carcinoma of the small intestine, five being in the duodenum, eleven in the jejunum, six in the ileum, and two cases of multiple lesions occurring in different parts of the small bowel. He attributed the discrepancy between figures regarding the anatomic distribution of malignancy in cases observed at the Mayo Clinic and elsewhere, to the fact that the Mayo

Clinic statistics were compiled from data taken at the time the patients were treated whereas statistics from other clinics were based on postmortem findings.

Since 1907 in the Mayo Clinic, 4,684 patients with gastro-intestinal carcinoma have been operated on, and the condition verified pathologically. The growth was in the stomach in 2,544 instances, in the small intestine in thirty-six, in the colon in 362, in the cecum in 135, in the rectosigmoid in 377, in the sigmoid in 293, and in the rectum in 937.

## PORTIONS OF THE GASTRO-INTESTINAL TRACT PREVIOUSLY STUDIED

*Carcinoma of the stomach.* MacCarty and Blackford in 1912 in studying the incidence of the involvement of the regional lymphatics in carcinoma of the stomach, found metastatic involvement in 52 per cent of the glands. They completed a study of 200 cases with 1,040 associated glands. The average age of the patients was forty-eight years, the average duration of symptoms was eight years. Males predominated, there being 74 per cent males and 27 per cent females. The resected specimens contained from one to fifteen lymph glands varying in size and appearance and necessitating microscopic examination, for it had previously been observed that large as well as small glands may be involved.

*Carcinoma of the large bowel.* Third in relative occurrence of carcinoma of the gastro-intestinal tract is carcinoma of the large bowel. Hayes, in 1921, has reviewed 100 such cases and 1,406 glands. Included in his series were the ascending colon, hepatic flexure, transverse colon, splenic flexure and descending colon to and including the sigmoid. The average age of patients was fifty-seven years, the average duration of symptoms nine and six tenths months. The number of males and females was equal. The associated regional glands were involved in 37 per cent of the

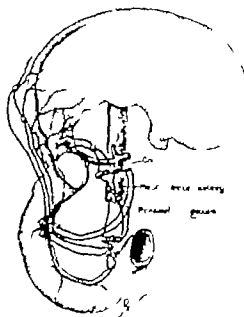


Fig. 1. Schematic diagram of lymphatic vessels and glands of stomach and duodenum, demonstrating their interrelationship and general plan of position.

cases. The relative frequency of malignancy is the reverse of the anatomic arrangement of the bowel: there were forty-two cases of carcinoma of the sigmoid, twenty-one of the descending colon, seven of the splenic flexure, sixteen of the transverse colon, nine of the hepatic flexure, and five of the ascending colon.

**Carcinoma of the rectum.** McVay in 1922, in reviewing 100 cases of rectal carcinoma and 623 associated lymph glands for metastatic involvement, found that 47 per cent of the glands were carcinomatous. The average age of the patients was fifty and eight tenths years, and the average duration of symptoms was ten and four tenths months. As in cases of carcinoma of the stomach, males predominated: 57 per cent of the patients were males and 43 per cent females. Here also it was found that the size of the lesion and the number of enlarged regional glands were no criterion of the incidence of metastatic involvement; for with a large intestinal lesion there might be extensive involvement or none, while with a small lesion of a greater or lesser degree of

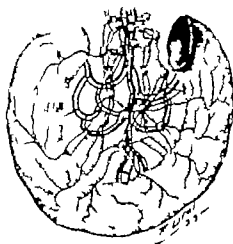


Fig. 2. Loop of small intestine showing the relationship of mesenteric lymphatics and blood vessels.

malignancy, the percentage of involvement might be more or less.

**Carcinoma of the cecum.** One hundred specimens with 1,033 glands were examined by MacCarty and Craig in 1923. There was metastatic involvement of 32 per cent of the regional lymph glands. The average age of patients was forty-eight years, and the duration of symptoms was nine and two-tenths months. Sixty-six per cent were males, and 34 per cent females.

#### PRESENT STUDY

**Carcinoma of the small intestine.** A review of the pathological material and clinical records of these cases demonstrated that it would be difficult to follow exactly the method pursued in the preceding studies. Whereas in the other portions of the gastro-intestinal tract the lesions had all been primary, certain of those in the small intestines were secondary and a few were indeterminate. By indeterminate is meant that a part of the pathological material proved to be associated with malignancy elsewhere in the bowel or peritoneal cavity, but such cases showed definite glandular involvement and were used to complete the percentage of incidence of metastasis. In view of this fact the cases were divided into



Fig. 3 Lymph gland showing metastases from colloid carcinoma



Fig. 4 Malignant papillomatous neoplasm which caused obstructive symptoms and ultimate intussusception

groups, the first comprising those which were definitely primary carcinomata, and the second, those which were secondary or indeterminate. There were thirty-six cases, and forty five associated regional lymphatic glands. The first group was further divided into the anatomic units of the small intestine and the duodenum, jejunum and ileum were regarded as separate units.

The lymphatics of the small intestine arise in the villi and form mucous, submucous, muscular and subserous plexuses. The lymph vessels of the duodenum follow the course of the blood vessels. From the anterior surface lymph vessels pass along the course of the inferior pancreaticoduodenal artery and communicate with the lymph glands along the course of that vessel, thence they pass to the inferior celiac glands beside the origin of the superior mesenteric artery. The vessels from the posterior aspect accompany the superior pancreaticoduodenal artery, communicate with the inferior gastric glands, and terminate in the celiac glands. Figure 1 is a schematic diagram of the lymphatic vessels and glands; the stomach is reflected upward, allowing the association of the lymphatics of the stomach and the duodenum to be demonstrated. The lymph vessels of the jejunum and ileum ascend between the two layers of the mesentery, and enter the mesenteric glands, which are situated mainly along the course of the blood vessels at various intervals. The vasa efferentia from these glands form the truncus intestinalis

which ends in the cisterna chyli. Figure 2 illustrates the lymphatic drainage of the jejunum and the ileum.

Carcinoma of the duodenum was found in six of the thirty-six cases and in only one of these was an operative specimen available. This proved to be a malignant papilloma; there was no associated glandular involvement. In order to reach a conclusion with regard to the incidence of glandular involvement, the postmortem specimens of four cases were examined. All proved to be accompanied by metastatic lymph glands. The appearance of these specimens seemed to indicate that metastasis had occurred to the regional glands in the other cases. The type of malignancy in all cases was adenocarcinoma of the cylinder cell variety and the lesions constricting in type were obstructing the lumen.

There were twelve cases of carcinoma of the jejunum and glands were obtained from the operative specimens of all but one in which exploration revealed inoperable malignancy. The only colloid carcinomata encountered were in the jejunum; there were three such cases (Fig. 3). In only one of the cases in which the bowel was resected with the associated glands, were the glands found to be inflammatory; the condition had metastasized to all of the other glands. This is not explained by the greater degree of malignancy of the neoplasm in this region, but by the fact that in nearly every case the symptoms were obstructive. Before the lesions became ob-



Fig. 5



Fig. 6



Fig. 7

Fig. 5 Microscopic section of case shown in Figure 4, demonstrating mitotic figures and undifferentiated epithelial cells.

Fig. 6 Gland from nascentary showing squamous-cell

epithelium associated with malignant abstracts of the ileum, secondary to malignancy of the cervix.

Fig. 7 Metastatic lymph gland from jejunum showing type of metastasis of gastro-intestinal carcinoma.

structive they must have advanced in size and extent far beyond that of other malignancy in the gastro-intestinal tract. Hence we see a higher degree of metastatic involvement. The average duration of symptoms was only five months.

The postoperative longevity was fair: the patients lived from two months to eight years after resection. When anastomosis around the lesion only was performed the patients lived from one month to two years.

Primary carcinoma of the ileum occurred in eight cases in seven of which resection was performed. However glands were obtained from only three. Microscopic examination revealed carcinomatous involvement in two and inflammation in one. The glands were evidently not removed with the specimen in the other cases. Here as in the preceding series, the average duration of symptoms was short, and the postoperative mortality high, which may possibly be explained by the late appearance of symptoms, and the advancement of the growth. In all but one case in this region the malignancy was of the adenocarcinomatous constricting type. The one exception was a malignant papillomatous neoplasm; the gross and microscopic aspects of which are shown in Figures 4 and 5. This papilloma caused intussusception, and was excised.

The cases which could not be identified with the primary carcinomata of the small intestine will be considered as a separate group and

discussed individually. With one exception, these secondary lesions occurred in the ileum, probably owing to the fact that the ileum is in closer proximity to the primary lesions. It seems probable that the secondary lesions are due to extension rather than true metastases through the lymphatics. Some of the patients were operated on, and the primary and secondary lesions removed together. In other cases, the secondary lesions became prominent at a later date after the primary source had been eliminated by operation.

#### ABSTRACTS OF CASES

CASE 27 (A5401) Illustrates the type of case in which the recurrence appears 3 years after the primary operation. An exploratory operation for carcinoma of the cervix was performed, and the malignant tissue removed. There was no trouble for 3 years, when obstructive symptoms were noted, and on opening the abdomen constriction of the ileum was found. There was marked glandular obstruction, and one of the glands as removed for one firmness of the diagnosis. Microscopic examination revealed definite carcinoma.

CASE 28 (A54974) Illustrates an unusual condition. The patient was a woman aged 41, five years, who came to the Clinic for malignancy of the cervix. An inoperable epithelioma of the cervix was found. Radical treatment was instituted and her condition improved. Six months later she returned with symptoms of obstruction, and on exploration, multiple constricting masses of the ileum were found. A lymph gland was removed for diagnosis and gave evidence of typical squamous cell epithelioma (Fig. 6).

CASE 29 (A14345) Illustrates another method of secondary metastasis to the ileum. This was a case of intracystic papillary adenocarcinoma of the ovary which had invaded the small intestine. The mass was removed and the glands showed metastatic involvement.

CASE 30 (A136413) A man, aged 3 years, had carcinoma of the sigmoid which he died and involved the ileum. Both growths were excised at the same operation. The glands were inflammatory.

TABLE I—CARCINOMA OF THE GASTRO-INTESTINAL TRACT

Location	Average age	Predominant sex	*Specimens	Glands	Percentage of glands involved	Average duration of symptoms, months	Immediate hospital mortality per cent	Total cases 1907 to '31
Stomach	48	Male	200	1404	51	9 <sup>5</sup>		544
Small intestine	48	Male	36	45	66	5	33	36
Large intestine	5	Male	100	1,206	3	8		613
Carcin	48	Male	100	1015	5	9	16	33
Rectum	50	Male	100	645	47	20		114

TABLE II—FINDINGS IN SIX CASES OF PRIMARY CARCINOMA OF THE DUODENUM

Case	Sex and age	Duration of symptoms, months	Diagnosis and operation	Pathological diagnosis	Subsequent history
(A4471)	M 37	73	Excision of entire duodenum Palatine gastro-jejunostomy		Death in two months
(A10497)	M 39		Malignant papilloma Resection		Lived two years
(A161596)	M 58	6	Carcinoma of first part of duodenum and pancreas	Postmortem examination of glands revealed carcinoma	Lived fourteen days
(A14337)	M 39	5	Carcinoma of first part of duodenum involved common duct inseparable	Postmortem examination of glands revealed carcinoma	
5 (A10941)	M 55		Exploratory operation inseparable carcinoma of stomach and duodenum	Postmortem examination of glands revealed carcinoma	
6 (A154796)	M 60		Carcinoma of the terminal portion of duodenum	Postmortem examination of glands revealed carcinoma	Lived three days

TABLE III—TWELVE CASES OF PRIMARY CARCINOMA OF THE JEJUNUM

Case	Sex and age	Duration of symptoms, months	Operation	Pathological diagnosis	Length of postoperative life, months
(A790)	M 50		Resection of jejunum	Inflammatory gland	14
(A10434)	M 40		Anastomosis for obstruction	Carcinoma	
(A13154)	M 49		Exploration inseparable	No glands	
30 (A10096)	F 49		Anastomosis for obstruction	Carcinoma	6
71 (A15006)	M 43		Anastomosis for obstruction	Carcinoma	24
(A10605)	M 57		Exploration inseparable	Carcinoma	(days)
5 (A134048)	M 44	6	Resection of jejunum	glands carcinoma	
(A137018)	F 34		Resection of jejunum	glands, colloid carcinoma	(days)
8 (A155000)	M 45		Resection of jejunum	glands carcinoma	
6 (A100000)	M		Anastomosis for obstruction	Carcinoma	
17 (A173790)	M 46		Anastomosis for obstruction	Colloid carcinoma	
13 (A130360)	M 36		Anastomosis for obstruction	Carcinoma	13 (days)



TABLE IV—EIGHT CASES OF PRIMARY CARCINOMA OF THE ILEUM

Case	Sex and Age	Duration of symptoms, months	Operation	Pathological diagnosis	Length of postoperative life, days
9 (A9097)	M 48		Resection of ileum	No glands	
10 (A9162)	M 55	8	Resection of ileum	1 carcinomatous and 1 inflammatory glands	1
11 (A9490)	F 44	15	Resection of ileum Ileocecectomy	Malignant lymphoma No glands	14 (trans)
12 (A9484)	F 44		Resection of ileum	3 carcinomatous glands	1
13 (A9435)	M 54		Exploration, ileocecal carcinoma	3-6 glands	
14 (A9506)	M 47		Resection of ileum	No glands	
15 (A9512)	F 50		Resection of ileum	Inflammatory glands	6
16 (A9513)	F 45	6	Resection of ileum	No glands	90

TABLE V—CARCINOMA OF THE SMALL INTESTINE

Case	Sex	Age	Duration of symptoms, weeks	Pathological diagnosis
(A9447)	M	51	1	Carcinoma
(A9497)	M	50	10	Carcinoma
(A9498)	M	50	10	Carcinoma
(A9499)	M	50	10	Carcinoma
(A9500)	M	50	10	Carcinoma
(A9501)	M	50	10	Carcinoma
(A9502)	M	50	10	Carcinoma
(A9503)	M	50	10	Carcinoma
(A9504)	M	50	10	Carcinoma
(A9505)	M	50	10	Carcinoma
(A9506)	M	50	10	Carcinoma
(A9507)	M	50	10	Carcinoma
(A9508)	M	50	10	Carcinoma
(A9509)	M	50	10	Carcinoma
(A9510)	M	50	10	Carcinoma
(A9511)	M	50	10	Carcinoma
(A9512)	M	50	10	Carcinoma
(A9513)	M	50	10	Carcinoma
(A9514)	M	50	10	Carcinoma
(A9515)	M	50	10	Carcinoma
(A9516)	M	50	10	Carcinoma
(A9517)	M	50	10	Carcinoma
(A9518)	M	50	10	Carcinoma
(A9519)	M	50	10	Carcinoma
(A9520)	M	50	10	Carcinoma
(A9521)	M	50	10	Carcinoma
(A9522)	M	50	10	Carcinoma
(A9523)	M	50	10	Carcinoma
(A9524)	M	50	10	Carcinoma
(A9525)	M	50	10	Carcinoma
(A9526)	M	50	10	Carcinoma
(A9527)	M	50	10	Carcinoma
(A9528)	M	50	10	Carcinoma
(A9529)	M	50	10	Carcinoma
(A9530)	M	50	10	Carcinoma
(A9531)	M	50	10	Carcinoma
(A9532)	M	50	10	Carcinoma
(A9533)	M	50	10	Carcinoma
(A9534)	M	50	10	Carcinoma
(A9535)	M	50	10	Carcinoma
(A9536)	M	50	10	Carcinoma
(A9537)	M	50	10	Carcinoma
(A9538)	M	50	10	Carcinoma
(A9539)	M	50	10	Carcinoma
(A9540)	M	50	10	Carcinoma
(A9541)	M	50	10	Carcinoma
(A9542)	M	50	10	Carcinoma
(A9543)	M	50	10	Carcinoma
(A9544)	M	50	10	Carcinoma
(A9545)	M	50	10	Carcinoma
(A9546)	M	50	10	Carcinoma
(A9547)	M	50	10	Carcinoma
(A9548)	M	50	10	Carcinoma
(A9549)	M	50	10	Carcinoma
(A9550)	M	50	10	Carcinoma
(A9551)	M	50	10	Carcinoma
(A9552)	M	50	10	Carcinoma
(A9553)	M	50	10	Carcinoma
(A9554)	M	50	10	Carcinoma
(A9555)	M	50	10	Carcinoma
(A9556)	M	50	10	Carcinoma
(A9557)	M	50	10	Carcinoma
(A9558)	M	50	10	Carcinoma
(A9559)	M	50	10	Carcinoma
(A9560)	M	50	10	Carcinoma
(A9561)	M	50	10	Carcinoma
(A9562)	M	50	10	Carcinoma
(A9563)	M	50	10	Carcinoma
(A9564)	M	50	10	Carcinoma
(A9565)	M	50	10	Carcinoma
(A9566)	M	50	10	Carcinoma
(A9567)	M	50	10	Carcinoma
(A9568)	M	50	10	Carcinoma
(A9569)	M	50	10	Carcinoma
(A9570)	M	50	10	Carcinoma
(A9571)	M	50	10	Carcinoma
(A9572)	M	50	10	Carcinoma
(A9573)	M	50	10	Carcinoma
(A9574)	M	50	10	Carcinoma
(A9575)	M	50	10	Carcinoma
(A9576)	M	50	10	Carcinoma
(A9577)	M	50	10	Carcinoma
(A9578)	M	50	10	Carcinoma
(A9579)	M	50	10	Carcinoma
(A9580)	M	50	10	Carcinoma
(A9581)	M	50	10	Carcinoma
(A9582)	M	50	10	Carcinoma
(A9583)	M	50	10	Carcinoma
(A9584)	M	50	10	Carcinoma
(A9585)	M	50	10	Carcinoma
(A9586)	M	50	10	Carcinoma
(A9587)	M	50	10	Carcinoma
(A9588)	M	50	10	Carcinoma
(A9589)	M	50	10	Carcinoma
(A9590)	M	50	10	Carcinoma
(A9591)	M	50	10	Carcinoma
(A9592)	M	50	10	Carcinoma
(A9593)	M	50	10	Carcinoma
(A9594)	M	50	10	Carcinoma
(A9595)	M	50	10	Carcinoma
(A9596)	M	50	10	Carcinoma
(A9597)	M	50	10	Carcinoma
(A9598)	M	50	10	Carcinoma
(A9599)	M	50	10	Carcinoma
(A9600)	M	50	10	Carcinoma

Average age of patients was 48 years

Average duration of symptoms was 10 weeks

Eighty per cent of the patients had involvement of lymph glands

Carcinoma was present in men

CASE 3 (A9455) A man, age 50 years, had carcinoma of the sigmoid. The growth had been excised, and one year later obstructive symptoms justified an exploratory operation. Carcinoma of the ileum was found, and was excised with the adjacent lymph glands. Five glands were dis-

sected out, and three of these were found to be malignant. The patient lived one year.

CASE 3 (A9400) A woman, age 33 years, had had obstructive symptoms for three months. Operation revealed malignant mass containing portion of the ileum, sigmoid, and uterus. This was excised and three mesenteric glands were found adjacent to the ileum, one of which was inflammatory, and the other two malignant. The primary lesion could not be determined.

CASE 33 (A90466) A woman, age 48 years, had had definite symptoms for 18 months and gradual enlargement of the abdomen. A malignant mass was found in the pelvis, and to it was attached the ileum. Examination of the mass revealed the fact that it was an epithelioma in dermoid cyst, no glands were involved.

CASE 34 (A9334) A man, age 35 years, had primary carcinoma of the sigmoid. The growth was excised, and the patient apparently recovered. Obstructive symptoms developed six months, and 1 operation mass was found in the ileum. A gland, removed for diagnosis, showed malignancy and an abscessoma was made around the lesion. The patient lived four months.

CASE 35 (A9494) A man, age 47 years, came to the Clinic with obscure obstructive symptoms. The operation revealed multiple lesions of the jejunum, and examination of 1 gland removed revealed typical median-epithelioma. It was later ascertained that a mole had been removed from the back three months before the onset of symptoms.

CASE 36 (A9367) Is of especial interest. A woman, age 45 years, came to the Clinic with obstructive symptoms. On opening the abdomen multiple lesions of the ileum were found. A gland removed for diagnosis proved to be carcinoma, and an abscessoma around the growth was made (Fig 8). The patient lived in comparative comfort for one and one-half years.

## SUMMARY

There was glandular involvement in twenty three (36 per cent) of the thirty-six cases of carcinomas of the small intestine. Eighty and seven-tenths per cent of the patients were males. The average age of the patients was

forty-seven and five-tenths years. The average duration of symptoms was five and four tenths months. Each case averaged one and twenty five hundredths glands.

Although resection of the bowel with all associated glands is the operation of choice, and produces the best postoperative results yet anastomosis around the lesion results in a high percentage of postoperative longevity.

In considering the three anatomic divisions of the small intestine with regard to post operative progress, in cases of carcinoma, it was found that the prognosis is most favorable in cases in which the lesion is in the jejunum. The hospital mortality was the least and the percentage of longevity greatest in these cases. Lesions of the duodenum are not only difficult to eradicate, but by the time they become manifest, they are so advanced that ablation is impossible. There seems to be a high hospital mortality from lesions of the ileum. The only patient living any length of time had a malignant papilloma which was extirpated, and there was no glandular involvement. Carcinoma of the small intestine is the least common form of gastro-intestinal malignancy. The majority of patients are between 40 and 60 years of age. The most common site of primary malignant neoplasm in our series was the jejunum, which contained 46 per cent of the carcinomata.

The size of the growth in the small intestine cannot be relied on as an accurate index of the probable lymphatic involvement neither can the history or duration of symptoms indicate the extent of metastasis.

Metastatic involvement of the lymph glands can be definitely determined only by systematic microscopic study of all regional lymph nodes. The size of the lymph node or the number of palpable glands has been proved not to be an index to the amount of involvement.

The microscopic study of the associated glands in this series has been of further diagnostic value in determining the type of malignancy especially in the cases which were secondary to malignancy elsewhere in the body.

Adenocarcinoma is present in all primary carcinomata of the small intestine, but the possibility of the growth being secondary must be kept in mind.

Malignancy of the small intestine may simulate the primary type and on microscopic examination prove to be secondary as is illustrated by the cases of melano-epithelioma and squamous-cell epithelioma, as well as by ovarian and uterine malignancies. Therefore, it is only by systematic microscopic examination that it is possible to rule out local metastasis in cases of carcinoma of the small intestine. A further important object of microscopic study is the determination of the type of malignancy which is an index as to the primary or secondary nature of the growth and as such assists in the prognostication.

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## UNILATERAL POLYCYSTIC KIDNEY

By MAURICE MELTZER, M.D. New York

UNILATERAL polycystic kidney is a very rare finding. The case reported in this paper should be entitled, *Clinical Unilateral Polycystic Kidney* for no one can state with certainty the condition of the opposite kidney. The infrequency of this unilateral entity is convincing in the following reports. Preitz in the pathological institute of Kiel in a series of 10,000 autopsies, found but 16 cases of unilateral disease. Seiber found 9 cases of unilateral disease in 149 cases of polycystic condition. The Boston City Hospital found 10 cases in 10 years in a series of 2,500 autopsies. Le Jars found only 2 cases among 63 adult polycystic kidney conditions. Ritchie found 2 unilateral cases in 72 patients.

In the literature it is difficult to find case reports of unilateral disease where the affected kidney is nephrectomized. There may be more of this kind of case in different urological clinics and it is hoped that such will be reported for statistical purposes. At best these cases are rather difficult to diagnose and most often the diagnoses are made at the operating table or in the course of routine autopsy. While the clinical picture of bilateral polycystic kidney is fairly well defined, that of the unilateral condition is not characteristic. The unilateral disease can easily be confused with any other surgical condition that affects the kidney.

Unilateral polycystic kidney as in the bilateral polycystic condition, consists of multiple cysts scattered through the kidney immediately beneath the capsule, so that the tumor often has a lobulated appearance. The tumor rather preserves the shape of the normal kidney but the surface is rough and irregular because of the superficial cysts. The color varies from greyish to a reddish or a light yellow and brown. The contained fluid is either thin and transparent, turbid, viscid or of a brown colloid color. In larger cysts the fluid may be serous with more or less blood, fat, and cholesterol. The cysts are separated by fibrous tissue or by renal parenchyma, which has undergone pressure atrophy and interstitial

nephritis, especially in the region of larger cysts. There is usually associated with this a dilatation of the renal pelvis and a thickening and kinking of the ureter. The size of the tumor mass varies from that above the normal size of the kidney to about 16 inches long. In the case reported in this paper the tumor was rather longer and larger than a football. When cut in the long diameter numerous cysts were revealed with an escape of brown gelatinous material practically no parenchyma was left. The affected side is usually the left. The disease usually occurs between 35 and 60 years of age though numerous pathologists feel that the condition is probably congenital. In the case to be reported the condition must have been latent and dormant for many years. Heredity seems to be a predisposing factor in some families. A careful family history of the case reported herein, revealed no symptoms of kidney disease in any other member. Osler reported five children of one mother with this disease. R. H. Crawford mentions numerous cases of polycystic kidney in a family tree of four generations. Borelius reports three cases of bilateral polycystic kidney in the same family. J. K. Love and Richmond report recurrences in one family. Flinterman reports polycystic kidneys in two sisters.

The pathogenesis of this condition is still a matter of theoretical speculation. There are the so-called congenital and adult types of the disease. Developmental defects of the kidney and interstitial inflammation of the kidney have been considered causative factors. But some stress the theory of malformation. Still others think that the cyst formation is due to occlusion of the urinary tubules. The duration of the condition is always hard to estimate.

Microscopically there is a thin cyst wall lined with epithelium. Often there are large numbers of epithelial cells in the contained fluid. The fibrous tissue varies in density. The tubules and the malpighian corpuscles undergo different changes, from slight dilatation to cyst formation. At times foci of leuco-

cytic infiltration are found and may be the cause of small abscesses. The associated lesions with unilateral polycystic kidney may be hypertrophy of the heart, arteriosclerosis, cyst formation of the liver meningocele, supernumerary digits, talipes, cleft palate imperforate anus, congenital urethral stricture with bilateral hydronephrosis, and cysts of the ovaries and the epididymides.

The symptoms are divided by Kidd into three stages:

1. The latent stage or stage of progressive enlargement of one or both kidneys without other symptoms. This may last from a few months to several years and may be discovered in the course of abdominal palpation.

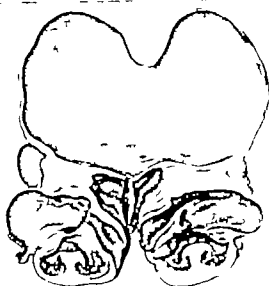
2. The stage of renal tumor and tumor mass. In this stage there may be no pain or a dull ache in the loin, or local pain and tenderness. Haematuria often occurs and is due to a rupture of blood vessels in the cysts. If blood clots are passed out through the ureter, colic like pains are experienced. Kinking of the ureter causes urinary stasis with pain and in time hydronephrosis develops. Symptoms of decreasing renal function such as nausea, vomiting, flatulence, constipation, and head ache are experienced. There is a polyuria with low specific gravity.

3. The stage of uremia.

Diagnosis of unilateral polycystic kidney is always puzzling. The condition can, at best, be only conjectured after various other surgical affections of the kidney have been ruled out. Cystoscopic and X-ray diagnoses are not of much value in this condition. The palpation of a tumor mass together with signs of falling kidney function, and the good fortune of having seen such a condition, should lead one to suspect polycystic kidney. As has been mentioned previously the discovery of this type of case is usually a matter of surprise either at the operating table or during an autopsy.

#### TREATMENT

In unilateral disease nephrectomy is the only rational measure. Life can thus be prolonged for many years if the opposite kidney is not involved. Other surgical procedures like decortication, puncture of the cysts as introduced by Rovsing and partial nephrectomy



This drawing represents the appearance of tumor cut in the long diameter. Lower half of tumor shows numerous collapsed cysts.

have been advanced but none of these is advisable or practical. If by cystoscopic examination and other tests the kidney function of the opposite side is normal or compensatory the diseased kidney should be entirely removed. This avoids unnecessary subsequent surgical procedures.

#### CASE REPORT

O. W. male, aged 30, was admitted into Broad Street Hospital, New York, on June 19, 1910. The chief complaints on admission were general malaise with high temperature and chills, continuous dull pain in the left loin and left half of the abdomen, the pain radiating toward the pubis. Urination was frequent but with no pain or haematuria. Four days prior to admission to the hospital he was cystoscoped at another clinic. The following day chills with high fever and the loin pain set in. When he was first seen

a large tumor mass similar to the enlarged spleen in spleno myelogenous leukaemia was palpated. The lower edge of the tender mass extended below the crest of the ilium. He was advised to enter the hospital for further study and was under observation for 4 days during which time there was no subsidence of the acute symptoms. The possibility of unilateral polycystic kidney or pyonephrosis with an acute exacerbation was considered. The family history was negative and had no bearing on the case. As a child he had measles and typhoid fever. He was temperate in his personal habits. Since early childhood he had always experienced dull pains in the left loin with

occasional and intermittent hematurias which would confine him to bed for a few days at a time. These attacks became less frequent in early adult life. For 6 months before admission to the hospital, the symptoms recurred frequently enough for him to seek advice.

The cystoscopic report showed that the bladder was normal. The right ureter was catheterized without difficulty and clear urine was obtained. The left ureteral catheter met an obstruction 5 centimeters from the reddened orifice and a viscid brown fluid coming at a more rapid rate was obtained. The kidney function from the right side was good but apparently no dye was secreted from the left side.

A blood culture was made and found to be negative. The hemoglobin was 58 per cent, the red blood cell count, 3,200,000, the white cell count, 12,750. The differential count, polymorphonuclear leucocytes, 84 per cent, small lymphocytes, 15 per cent and large mononuclear per cent. The blood chemistry showed no retention of nitrogenous material. The following figures were obtained, urea nitrogen 3.7 milligrams per 100 cubic centimeters of blood, uric acid 1.60 and creatinine 1.5. The urine analysis showed a trace of albumin but nothing else of importance.

The general physical examination showed no disease of any other organs.

Inasmuch as he showed no improvement under the usual palliative treatment, a nephrectomy was decided upon. On June 23, 1922, the usual left loin incision was made and an enormous dark brown lobulated kidney tumor was found. It was necessary to puncture two of the posterior cysts about 400 cubic centimeters of viscid brown colloid material drained out. The lower pole of the tumor extended below the crest of the ilium and was delivered with great difficulty. The ureter was very much thickened. The entire thickened kidney pedicle was clamped with two heavy Kocher clamps and the kidney was removed. It was not considered safe to remove the clamps so they were left in place for 3 days. Toward the close of the operation, the patient went into shock. The pulse was very rapid and difficult to estimate. He was infused while on the operating table and the rectal sphincter was dilated. He rallied.

The patient made a rather uneventful recovery and was out of bed 19 days after the operation. He was discharged on July 31, 1922, in excellent general condition. The urinary secretion at this time was between 20 and 30 ounces of normal urine. An intramuscular injection of phthalein several weeks later showed secretion of 75 per cent of the dye from the remaining kidney. The patient's condition has been followed up by correspondence. He reports normal health and attends to his usual occupation.

## ARBORESCENT LIPOMATA OF TENDON SHEATHS

## A REPORT OF TWO CASES

By J. RENFREW WHITE, M.S. F.R.C.S. (Eng.) DUNEDIN, NEW ZEALAND

IN the August, 1922 number of SURGERY, GYNECOLOGY AND OBSTETRICS a case of arborescent lipomata of tendon sheaths was reported by A. Strauss of Cleveland, Ohio the description of this case was followed by a most interesting and exhaustive analysis of the 18 cases so far reported in the literature the first case being that reported in 1885 by Pavloff. The present writer noted with interest the extreme rarity of this condition as evidenced by the small number of cases reported and by the fact that no surgeon had reported more than one case of his own observation.

During the last 3 years the writer has had the curious fortune to meet with two cases of arborescent lipomata of the tendon sheaths about the ankle joint the first patient consulted him for swollen, painful, and deformed feet of 7 or 8 years standing on October 13, 1920, while the second patient presented himself on January 10, 1922. The writer has been moved to publish an account of these by a study of Strauss' excellent and stimulating article.

The first patient a man aged 38, a packer by trade, lumped into the writer's consulting room with difficulty and obvious pain pointing to his feet, he complained bitterly of pain and suffering disabling him to the extent of interfering with his power of earning a livelihood. The swelling and pain had been of gradual onset and development but both had been extreme for 2 or 3 years. He had consulted doctors but none had been able to give him relief. When this patient removed his boots and stockings, the writer saw such pair of feet as presented a clinical picture entirely new and amazing to him. He recognized at a glance that this condition was for him something altogether new. The accompanying pictures unfortunately give but a poor idea of the appearance they presented.

The three most striking abnormalities that were to be made out on examination were:

1. Large bulging swellings following the course of the tendons lying behind the two malleoli and extending both on the inner and the outer side of the foot into the sole. These were soft and fluctuating, without giving crepitation on movable pressure or

on active movement of the underlying tendons. A certain amount of fine lobulation was, however, to be made out the edges of the swellings were all defined from the surrounding parts. The skin was freely movable over the swellings.

Extreme distortion and displacement of the toes. The four outer toes were drawn up into a hyperextended, indeed, subluxated position on the dorsum of the foot and clawed, leaving the metatarsal heads prominent and projecting on the sole of the foot. The hallux was in addition to being hyperextended, drawn into a marked varus position on the metatarsal head. The deformity of the toes was fixed incapable of correction by either active or passive force.

3. A marked degree of laxity of the ligaments of the ankle and tarsal joints associated with an extreme permanent eversion of the feet at these joints. Partly owing to this and partly to the swelling over the lower part of the tibialis posterior tendon on the inner side of the foot, both feet appeared excessively flat.

What constituted, however, the most surprising factor in the clinical appearance was the extraordinary symmetry of the two feet. In both, the position, size and shape of the swellings, the nature and degree of the distortion of the toes, and the degree of the flat foot were absolutely identical.

A diagnosis of tuberculous tenosynovitis was made and the patient admitted to hospital. A ray examination showed nothing but a well marked spur on the under surface of each os calcis. The Wassermann reaction on the blood was negative.

The true nature of the swellings only became obvious during the operation. The writer had operated on cases of arborescent lipomata of the knee joint and recognized the similarity of these swellings to this condition. Nevertheless the pathological findings at operation were sufficiently astonishing. Growing around and from and indistinguishable from the wall of the tendon sheaths was a mass of finely lobulated and vascular fatty tissue the bulk of the swelling however consisting of shaggy villi loaded with fat projecting into the synovial cavity at all points from parietal and vascular layers of the sheaths alike. In places apparently some of these villi had become hemorrhagic, being fibrous and in places blood stained a few had apparently become detached from their pedicles and lay as loose bodies inside the sheath. Where the peroneus longus tendon sheath descended into the sole of the foot so that the masses of villous fat had been subjected to continual pressure the fat was largely missing, the villi here being composed of

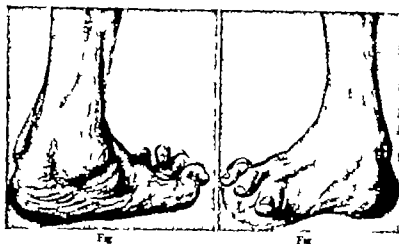


Fig. 1. Arborescent lipomata of tendon sheaths of tibialis posterior and peronei associated with extreme deformity of the toe. Note in this figure the swelling along the course of the tendon of the tibialis posterior, the hyperextension with subluxation of the four outer toes and the hyperextension with adduction of the great toe.

Fig. 2. Arborescent lipomata of tendon sheaths of tibialis posterior and peronei associated with extreme deformity of the toes. Note the swelling along the line of the peronei tendons.

fibrous tissue the largest of these, of the size of a large marble and hard as cartilage lay in the sheath attached to its parietal layer beneath the cuboid bone by a very thin and narrow pedicle. The condition found in all four positions in the two feet was practically identical.

A most striking phenomenon of the pathological picture, however, was the manner in which projecting villi of fatty tissue had grown through the interstices of the neighboring ligaments into the tarsal joints not only so but where the sheaths became continuous with the periosteum of the backs of the malleoli, similar fatty villi were found that had grown through tiny holes through this periosteum and had actually eaten their way into tiny pits in the bone itself.

The masses were stripped from the tendons which were cleaned throughout their length. Further operations were found necessary, however, to correct the deformities and make the feet painless for walking. Thus on each side, by tenotomies and excision of the heads of the metatarsal bones, the displacement of the toes was corrected and the pressure of the weight of the body through the metatarsal heads relieved. The spurs on the heels were removed. An arthrodesis of the first metatarsal and subastragalar joints was performed to stabilize the foot and correct the valgus deformity.

There has been since no sign of recurrence of the lipomatous masses.

The second case, a policeman, aged 35, presented himself on January 10, 1923, complaining of pain and swelling on the inner side of the left ankle, of a duration of from 8 to 10 years. He had been examined by many doctors; he had complained of this trouble often while in the army throughout the duration of the War. Examination showed diffuse, soft, elastic swelling without clearly defined edges and with fine lobulation lying along the course of the left tibialis posterior tendon. Though of much smaller size the swelling reminded the writer of those of the first case and he made tentative diagnosis of lipoma of the tendon sheath. He advised its removal. During the operation all the changes seen in the first case were recognizable in less developed state but the resemblance between and the identity of the two conditions were unmistakable. This patient was relieved of all his symptoms by the operation.

It seems to the writer impossible in the first case to be certain whether the deformity of the toes was an independent phenomenon or one connected in any way with the presence of the lipomata. There is no doubt, however, that the flail condition of the tarsal joints was largely the result of the weakening of their ligaments through stretching and of penetration by lobules of the tumors.

## HYDATID CYSTS OF THE SPLEEN WITH REPORT OF FOUR CASES

By H. W. MILLS, M.R.C.S. (Ed.) L.R.C.P. (Lond.) F.A.C.S. SAN BERNARDINO, CALIFORNIA  
*Ransom Hospital*

**H**YDATID cysts of the spleen are rare comparatively so for the world in general actually so in the case of America. Statistics vary very much and as has been pointed out by Dévé are vitiated by the fact that enough care has not been taken to segregate primary and secondary cysts. Hector McKenzie has pointed out that Thomas' statistics for Australia are particularly weak, not only for the reason mentioned above but also because they include many outside cases.

It is a curious fact too that the relative incidence of splenic cysts varies considerably in different parts of the world. Thus they are notably infrequent in Iceland and Australia (Warot) two of the most hydatid infested countries in the world. Finzen gives the Iceland statistics as 0.78 per cent. As regards Australia a perusal of the voluminous literature on this subject bears out Warot's statement and Wilson, of Adelaide, states that in South Australia hydatid cysts of the spleen are comparatively rare.

In Braquehaye's recent statistics, 2.6 per cent were hydatid cysts of the spleen.

Without going deeper into this matter one may safely take Dive's figure of 2.1 per cent as to all intents and purposes correct.

In the Argentine Vegas and Cranwell's estimates of 3.7 per cent must be accepted. Albou of Uruguay notes that in Montevideo Hospitals, from 1908 to 1912 out of 375 cases of hydatid cysts, there were three of the spleen. He quotes Pena to the effect that in the children's clinic, from 1896 to 1913 out of 150 cases operated upon (125 personal) there were two hydatid cysts of the spleen. This gives us a percentage of about 1 per cent for Uruguay. The combined South American statistics (Argentine and Uruguay) work out at 2.3 per cent i.e. approximately the same as those of Dévé. Greenway's statistics for Argentina show 2.14 per cent for the spleen.

On the continent of Europe Trinkler has pointed out that whereas hydatid cysts of the

spleen are fairly common in France and Germany—most authors think more so in the latter country (Lainé, Warot, Martin)—Russia should be accorded the first place in this respect for though in his list of 70 cases 48 came from France and Germany and only 7 from Russia yet the latter obtained in a period of 5 years, while the former went back to 1790. Fowler's combined statistics (1922) showed 191 reported cases up to 1894.

This relative world-infrequency of hydatid cysts of the spleen is not surprising when we reflect that the liver filter stops 75 per cent of the hexacanth embryos and the lung-filter an other 10 per cent, so that only 15 per cent are left to develop into cysts in other parts of the body. Moreover not every embryo survives on the contrary most of them fall by the way side for man is not by any means a favorite secondary host of the *tenia echinococcus*.

The route of invasion is now conceded to be via the blood stream, though Gangolphe taught that the lymphatic one obtained. The latter is quite unproven, and the possibility thereof rests on two cases, one of Dévé's (primary hydatid cyst of a mediastinal lymph gland) and one of Dufau's quoted by Roche in which an hydatid cyst was found in the interior of an inguinal gland in a female in 1892 who also had an hydatid cyst of the liver. This was probably a case of contemporaneous primary development of cysts in the liver and in the inguinal gland. The latter cannot have been secondary to the former as though hydatid sand might have gained access to the inferior vena cava by rupture the elements contained—brood capsules and scolices—would have fetched up in the pulmonary capillaries. The latter will transmit the hexacanth embryo but not the scolex, which is five or six times as large.

The somewhat fantastic theory has been championed by Cras, and passively accepted by subsequent authors that the larvæ may migrate upstream by a sort of reflux into the spleen from the portal vein. Vegas and Cran-



well have pointed out that if this actually were so one ought to find as many primary hydatid cysts in the spleen as in the liver.

Again, Chachereau has been at pains to suggest another weird route, and thinks that the embryos, with truly malignant ingenuity bide their time and instead of perforating the gut high up wait until they have arrived at the rectum and can take advantage of the fact that they can thereby short-circuit the liver and lung filters and arrive at the heart via the hemorrhoidal veins.

One is prepared to admit the hardness of the parasite after reading Leidy's account of living brood capsules in a hydatid cyst the host of which—a dissecting room subject—had been pickled for months in zinc chloride but the above mentioned conduct of the embryo strikes one as, to say the least, improbable.

Finally Mariau has observed in the newly born small veins passing from the splenic flexure of the colon to the lower pole of the spleen—another back door for the irrepressible embryo! But why look for bizarre methods of attack when the simple one is so obvious? The hexacanth embryos with a loss of 85 per cent of their effective strength arrive, via the liver and lungs, at the left heart, whence the 15 per cent of survivors are distributed throughout the body. Seeing that, for mechanical reasons, the brain takes the first toll of these and that both the kidneys and muscles and connective tissue take precedence over the spleen (D'v) 2.1 per cent is a very fair share for the latter which quā primary hydatid cysts in order of frequency of organs involved comes fifth in the adult and sixth in the child (D'v).

#### HISTORICAL

All the earlier cases were regarded as post mortem rarities. Berthelot appears to have reported the first case in 1790. In 1808 Ludenon added another. But the condition was almost unknown before 1821 when Morgagni published his (autopsy) case. This was followed by Barret's case, also a postmortem observation, in 1827. Other cases were recorded by Deguille in 1850, Vossin (autopsy record) in 1852, Davaine in 1860 and Magdelain in 1868. Bessier in 1875 brought the subject up to date and Lefèvre's thesis ap-

peared in the same year. In 1876 Braut published his case in which "*hydatidenterie*" obtained postmortem. It was found that an enormous hydatid cyst of the spleen had ruptured into the transverse colon. Various theses rapidly followed—Le Noel, 1879; Laine, 1888; Casanova and Trinkler 1893; Cras, 1896; Roche and Vanvert, both in 1897; Baraduc, 1898.

In 1889 Quéru recorded a case successfully treated by the transpleural route, and Lepre vost one which recovered after being twice tapped. Dieulafoy's two lectures at l'Hôtel Dieu were delivered in 1899, and remain to this day a classic on this subject. He reported two personal cases.

Apparently in Germany only five cases of hydatid cyst of the spleen had been reported up to 1889 of which three were by Madelung (1885).

Trinkler collected 70 cases including his own, which recovered after operation in two stages. These were all the cases known up to 1891.

Cras thesis was based on 14 cases including two personal ones. The first patient recovered after incision and drainage. The second, who had a suppurating hydatid cyst of the spleen which perforated the diaphragm, died after a transthoracic drainage operation.

Roche's thesis was based on two previously unpublished cases of hydatid cyst of the spleen from Marseille. The first patient recovered after marsupialisation of the cyst.

#### CLASSIFICATION

Since the appearance of Dieulafoy's masterly articles in 1898, his classification of hydatid cysts of the spleen into cortical, central and juxtasplenic, has been universally accepted by all subsequent authors (Scherb has added the abdominothoracic form). Likewise his types—ascending (immobile) and descending (mobile).

From a surgical point of view we may with Segond and Potherat, divide hydatids of the spleen into three groups:

1. Those containing much fluid but few daughter cysts.
2. Those packed with vesicles.
3. Suppurating cysts.

Martin in 1908 described in detail the various anatomicopathological and clinical forms as follows:

- a. The anterior cyst (gastrosplenic) frequent (vide Chaintre and Casanova)
- b. The posterior cyst—pancreatic-splenic (vide Gallozi and Hahn)
- c. The superior cyst which often contracts adhesions with the left lobe of the liver and diaphragm (vide Chaintre)
- d. The inferior cyst. Common Adhesions with small intestine (vide Sokoloff Brault, Lucas-Championnière)
- e. The parietal cyst. Secondary infection from trauma often occurs and the contents may become purulent or bloody

There is no general consensus of opinion as to the relative frequency of Dieulafoy's forms. Thus Davalné regards the cortical as the most usual one, and of course Bland Sutton concurs believing as he does that the subperitoneal connective tissue is the selective habitat of the parasite in man.

On the other hand Mortureux, Dieulafoy, Hanot and Hahn regard the hydatid cysts of the spleen as "usually a central tumor with surrounding compensatory splenic hypertrophy."

Practically however it is not of great importance whether the cyst begins as a central one and is subsequently "externalized," or whether it originates superficially and subsequently penetrates into the substance of the spleen.

The juxtasplenic cysts are usually of secondary origin.

#### COURSE AND SYMPTOMS

The early development is insidious and the evolution very slow. Symptomless abdominal enlargement is often the cause of the patient seeking medical aid. Thus Quénu and Duval's patient considered herself pregnant. It is only where pressure on the surrounding organs occurs, owing to the increasing size of the cyst, that pain is complained of. The entire course may be symptomless (Kehlberg, Wilde).

Generally speaking the symptoms are abdominal in the descending type—dyspepsia, nausea, vomiting, vague intra-abdominal

pains, a sense of heaviness in the abdomen, symptoms of intestinal obstruction (Sokoloff) and thoracic in the ascending type—dyspnoea (15 per cent in Trinkler's 70 cases) symptoms of pleuropneumonia (Durozier) etc. These symptoms are, of course, common to all cysts of the spleen (blood and lymph cysts as well as hydatid cysts).

Pain in some form however according to Dieulafoy is usually one of the earliest symptoms. It may be so severe as to suggest tabetic crises (Chaintre). It may simulate intercostal neuralgia (Concetti). It may be absent from beginning to end (Bezanson). Other symptoms which have been noted are a change of character and neurasthenia (Cras), mild icterus (Bourdell), hæmaturia (Kuehn), local crawling sensations (Reboul) also the impossibility of lateral decubitus (Roche and others).

Frequently symptoms have appeared only after trauma, as in the cases of Ikawitz, Vivenza, Leprévost, Roche (postmortem).

The general condition of these patients is notoriously good, and may be a factor in arriving at a correct diagnosis.

Whatever the form of the tumor the cyst itself is absolutely spherical (Dieulafoy) and compensatory hypertrophy of the spleen obtains analogous to that which Hanot, Hahn and Pontick have described in the case of the liver so that even after the removal of a large cyst, what is left of the splenic pulp often weighs much more than a normal spleen does. In Snegirew's case the spleen was three times as large as normal.

Ultimately suppuration of the cyst with inflammatory adhesions to neighboring organs and perforation of the diaphragm with the result of sudden death or perhaps evacuation via a bronchus or into the stomach (hydatidomèse) intestine (hydatiden tene of Dévé) or abdominal cavity may occur. In case of traumatic rupture of a fertile non-infected cyst secondary abdominal insemination may be expected. Very rarely external rupture has been observed (Warot, Brault).

According to Litten (cit. Moynihan) calcification of the walls of splenic cysts is rather common. Vide also Gérin-Rose and Bougie.

Cases of spontaneous cure have been recorded (Bastian Vegas and Crankwell and one in Barts Hospital reports, vol. viii p. 180)

#### DIFFERENTIAL DIAGNOSIS

The differential diagnosis is from

1. Non parasitic cysts of the spleen (true and pseudo-cysts, vide Fowler and Powers) which themselves are only distinguished from other splenic tumors by the presence of fluctuation (Mosler cit. Trinkler). Solid tumors of the spleen—the various forms of splenomegaly, malaria, leukemia, etc. (Picoud and Ramond). Primary carcinomas or sarcoma of the spleen of which 43 cases have been recorded to date according to Fowler (vide Gaucher Debove Wicksellbaum Jepson and Albert, Council Jepson, Denver Bush, Friedrich, De Renzi, Solis-Cohen and Riesman Goldstein). Primary tuberculosis of the spleen (Rendu and Vidal, Lefay, Moutard, Martin, Guiliand). Dermoid cysts (Andral) two dermoid cysts and 90 cases of genuine and false non parasitic cysts of the spleen have been reported in the literature to date (Fowler).

2. Tumors of the Kidney and Floating Kidney. Putain mistook a hydronephrosis for a splenic cyst, and Gérard-Marchant a renal cyst for a splenic one.

3. Pancreatic cysts, lymphatic cysts of the great omentum and retro-omental pseudo-cysts (Bolognesi, Fornicelli, Arzela).

4. Cysts of the pelvic connective tissue.

5. Ovarian cysts, dermoid and others (Cabannea).

6. Mesenteric cysts (vide Braquhaye, Tillaux and Tomiselli) of which the signs are excessive mobility, a porous sound between abdominal walls and tumor and another above the pubes.

Hydatid fever is rare—more so according to Martin than in hydatid of the liver—and not pathognomonic (Cardarelli, Jones). It was noted in the cases of Jachard (cit. Mortureux), Magdelain, Trinkler, Tudenat, Martin, Zak. Maxwell noted it in a distended urinary bladder.

The complement fixation test when the cyst is active is positive in about 90 per cent of cases.

*Cason's Intradermal Test.* Pontano regards Cason's intradermal test as a very sensitive and reliable test in man.

It was positive in 84 per cent of his cases against 66 per cent by the subcutaneous test and 50 per cent by the complement fixation test. In only 40 per cent of cases did he find that eosinophilia was increased. The presence of eosinophiles is confirmatory evidence only of hydatid disease (Sabrazes, Tuffier and Milian, Memmi, Duguin and Triboudeau) and may occur with splenomegaly in the absence of hydatid disease (McDonald and Shaw). To the long list of conditions in which it is found there must now be added—as Laque and Atrakl have recently shown—enlargement of the prostate.

Fernandez Ithurrat advises that four biological tests be made: the complement fixation, the complement fixation with unheated serum, determination of eosinophilia, intradermic reaction. He regards the intradermic as the most sensitive and rapid diagnostic method.

Pasquale del Torto regards the complement fixation test as the most exact but advises that the intracutaneous reaction (the technique of which is easy) should also be employed.

#### TREATMENT

This is purely surgical and the choice lies between

1. Aspiration with or without the injection of parasitocides—mentioned only to condemn. (For death after puncture vide Chaulard, Guillet, Rambesau, Harley).

2. Marsupialization and drainage. Unsatisfactory in that it is so often followed by chronic fistule and post-operative hernia. Thus, of Casanova's eight cases, only one resulted in a satisfactory cure. It is, however, the operation of choice in suppurating cases where as the result of dense adhesions, splenectomy is impracticable.

3. Exosplenectomy. It is conceivable that under rare circumstances this procedure may have a limited field of usefulness. But the description by its principal advocate Villar leaves one surgically cold. Jaboulay who had used a similar technique for gastric cancer tried it on the spleen in 1893 but had to resort to

splenectomy because of hemorrhage. In 1894 he tried it again. His patient died of phlegmon of the neck. There are six reported cases of this operation: Jaboulay 1894, Houzel 1897, Baudrimont, 1897, Qufnu and Baudet, 1895, Villar two cases, 1894 and 1895, his earlier case (leukopenic spleen) dying from hemorrhage. Out of these six cases there were two complete cures—those of Houzel and Qufnu and Baudet. (Vide also Bender and Hayden.)

4. Capitonnage of Delbet, who had one successful case. Impracticable in some cases, i.e. cysts in a high position or with calcified walls and contra-indicated in suppuration.

5. Extirpation, i.e. amputation. Suitable for juxtaspenic cases only.

6. Splenectomy. Has been condemned as too radical by some of the older authorities (Chalantre, Beulier, Mortureux, Cras, Blum, Poulet, Roche). Also by Warot (usually) by Finkelstein and by Vegas and Cranwell—the two latter very high authorities.

Martyn-Jordan has perhaps written the most eloquent plea for conservatism and shows that a partial splenectomy (limited to the lower half of the spleen) is a safer operation in dogs than splenectomy. It is on the other hand accepted as the operation of choice at any rate in the absence of infection or dense adhesions by Hahn, Driacourt (when cyst is intraspenic and spleen mobile), Winckel, Vanverts, Jonnesco, Jordan, Février, Hartmann (when spleen is mobile), Dieulafoy, Casanova, and most recent authors, for only thus can we be sure that recurrence will not take place from an overlooked second cyst, and anticipate a rapid recovery. This tendency to the more radical operation is natural, for as the result of the many successful cases of splenectomy for various conditions, e.g. hemolytic jaundice in recent years, few will nowadays deny Dieulafoy's dictum that splenectomy causes transitory blood changes only. Incidentally congenital absence of the spleen is not a serious handicap (McLean and Craig).

It is only right to mention that some authors hold different opinions (Gechet and Pachon, Beau, Charrin, Pitts and Ballance, Lewerenz, Ascoli). In this connection one might mention the observations of Steuben-

rauch who found splenic nodules scattered throughout the peritoneum of patients on whom splenectomy had been done a year or two previously, i.e. compensatory hypertrophy of accessory spleens.<sup>1</sup> Macht and Finesler have recently shown that in rats the muscular integration is improved if anything, after splenectomy.

All Trinkler's splenectomy cases recovered except that of Koeberle and here previous tapping was partly responsible for the result.

In 1867 Péan reported a successful splenectomy for cyst of the spleen, but according to Roche this was not an hydatid cyst, though Vanverts classifies it as such.

Koeberle's splenectomy for hydatid cyst was the first recorded case (1873). His patient died. Successful cases were shortly after reported by Crédé, Thornton, Fehleisen, Wright (3 cases) and Mas, 1889 (the first successful Spanish case).

Among Cras 14 cases of hydatids of the spleen (1896) one (obs. 11 Hahn) was treated by splenectomy and recovered.

Vanverts, the first great advocate of splenectomy for this condition, reported in 1897 18 cases with 15 recoveries, i.e. a mortality of 16.5 per cent and states that the suppression of the functions of the spleen causes no danger in man or animals. Its functions are probably assumed by the lymphatic glands and the bone marrow.

Février (1901) adds three (Moulouquet, Carnabel, Slavcheff) to Vanverts' list of these 21 cases 18 were cured—mortality 14.3 per cent.

In 1901 Leonté of Roumania, reports 12 cases with 8 cures—an unusually high mortality.

In the same year Tédénat quotes Hahn's 7 cases with 5 cures and Moncatello whose mortality was 14.2 per cent—compare Trofinoff's mortality of 28 per cent for incision and drainage. One of his personal cases recovered after splenectomy, the other was treated by incision and drainage, and rupture into a bronchus occurred.

Villar in 1903 writes of splenectomy as the operation of choice, and with Jonnesco ad-

<sup>1</sup> Cf. J. F. Cannon, *Ann. Surg.* 1922, April, 7:26. Vide, also, H. Kegan.

vises the surgeon to stand on the right side of the patient during the early stages of the operation.

Jordan 1903 reports a successful case of his own and abstracts 17 from literature with 15 cures, a mortality of 11.8 per cent.

Warot (1905) gives the mortality as 11.1 per cent in 45 cases (Vanverts 18 Villar 2 Dieulafoy 1 Driaucourt 3 Jordan 17 Hartmann 2, personal 2 Poncet and Delore 1) but as in this list the cases of Mas, Hahn, Snegulrew, Richelot and Hartmann are reduplicated appearing as they do in the previous lists of both Vanverts and Jordan, Warot's list should read "40 cases with 5 deaths" i.e. a mortality of 12.5 per cent.

Granowsky in 1905 reported one case of splenectomy for hydatid cyst of the spleen with recovery.

In 1906 von Schmarda reports a successful case and mentions 26 splenectomies from literature in addition to another (unpublished) case similar to his own.

In 1908 Johnston, of Richmond, Virginia cited 8 successful cases reported between 1900 and 1908 (Carnabel Delore Slavchev Tricom-Latarjet Jordan, Giannettasio, von Hertzel). Of these I have been unable to locate the last and the first five are included in Warot. He gives the mortality up to 1908, as 17.8 per cent.

Martin in 1908 reports three splenectomies for hydatid cysts of the spleen with two deaths.

In 1911 Blondi reported a successful case and Froelich another in 1913. Fowler in the same year quotes Bergman's case as the second successful one of splenectomy for hydatid cysts of the spleen, and states that up to 1890 there were 58 records of solitary hydatid cysts of the spleen reported and that other organs were affected in 43 of them. He gives the mortality of splenectomy as 17 per cent. The same author writing in 1922 gives the mortality in 48 splenectomies for hydatid cyst (Finkelstein 46 Sherren 1 Hiltzot 1) as 15 per cent.

Finkelstein (Russia) 1914 reports two personal cases of splenectomy for hydatid cysts.

Sherren reported a successful case in 1914

Edelman of New York performed a successful splenectomy for hydatid cyst in 1921.

Mei from his experience among the Bedouin tribes in North Africa, prefers marsupialization.

The case reported in 1922 by Lubbers and Noordenbos, of splenectomy for hydatid cyst of the spleen died.

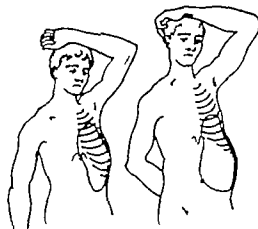
Thus we have 56 cases: Moulonguet 1 Warot 40 Granowsky 1 von Schmarda 1 Johnston 3 Martin 3 Blondi 1 Froelich 1 Sherren 1 Finkelstein 2 Lubbers and Noordenbos 1 Edelman 1 of these 8 died a mortality of 14.3 per cent.

This mortality is reasonable, and by careful selection of cases could be still further reduced probably to the figure suggested by Mayo in 1913 for splenectomies in general i.e. 5 to 10 per cent.

Partsch has pointed out that most fatalities after splenectomy are due to hemorrhage as a result of adhesions and that only the induction of pneumoperitoneum can give a clear conception of the extent of such adhesions.

It is only right to add that, while investigating the subject on the occasion of the recent visit to South America under the auspices of the Clinical Congress of the American College of Surgeons I found that the majority of the leading surgeons in Argentina and Uruguay—and they are all experts in the matter of echinococcosis—were by no means wedded to splenectomy as a routine treatment for hydatid cysts of the spleen. On the contrary they reserve this procedure for cases of multiple cysts of the spleen, or those in which the spleen was practically destroyed by one enormous clean cyst. Smaller clean cysts they preferred to treat by the closed method (Lagos Garcia reported in 1908 five cases in children so treated) and suppurating cysts by marsupialization.

The use of Finocchetto's aspirator is still regarded as *sub judice*. In two cases (both hydatid cysts of the liver) in which I saw it used, a considerable amount of fluid escaped around this enormous trocar as it was plunged in. Extreme care had been taken to pack off the field but some contamination of the lips of the wound may undoubtedly occur in such cases.



Fig

Fig

Fig 1. Hydatid cyst of spleen ascending type (After Deneufloy Les kystes hydatiques de la rate Paris 898-99)

Fig. Hydatid cyst of spleen descending type (After Deneufloy)



Fig 3. Hydatid cyst of spleen, illustrating the spherical form of the hydatid cyst, and the compensatory hypertrophy of poles of the spleen (After Deneufloy)

CASE 3 1917 Postmortem case in the practice of D Stanley P Black, the late well-known pathologist of Los Angeles. Because of Dr Black's untimely death I have been unable to secure details of this case beyond the fact that it came from Southern California, that the patient was a foreigner and that hooklets were demonstrated.

CASE 4 1921 Private communication from Dr W A Downs of New York. Italian man just arrived in America. Solitary echinococcus cyst of the spleen. Operation. Recovery.

#### HYDATID CYSTS OF THE SPLEEN IN AMERICA

Lyon's list of 241 cases of hydatid cysts up to July 1 1901 incorporating the previous ones of Osler and Sommer included 9 of the spleen, i e., 3.7 per cent.

Up to the present date, out of some 200 subsequent cases of echinococcosis which I have collected from North American literature there have been only three reported cases of hydatid cyst of the spleen—one by Cahana in 1917 one by Jones in 1920 and one by Edelman in 1921. To these I now add four previously unpublished cases.

CASE 1 Courtesy of D H H Sheri, of Pasadena, California, 1907. Danish female, age 22, urine, 4 years in America. Diagnosis ovarian cyst. At first operation, three large omental cysts, the size of a coconut and full of daughter cysts are removed. At second operation, mass consisting of three large splenic cysts, the size of fetal head. Marked hydatid intoxication. Marsupialization, prolonged suppuration, ultimate complete cure. Diagnosis verified by Dr Stanley P Black, of Los Angeles.

CASE 2 (courtesy of Dr M Isanardi of San Francisco) Basque shepherd, age 30, 6 years in America, was operated on in 1913 for hydatid cyst of the spleen. This case was again operated on by D Rixford, in the temporary absence of Dr Isanardi, for a recurrence in 1916, on this occasion the cyst full of daughter cysts, had ruptured into the abdominal cavity. Marsupialization. Recovery. Eosinophilia 17 per cent.

Thus 16 cases of hydatid cyst of the spleen are all that have been reported in the entire literature of North America to date so I think that my statement at the beginning of this paper that hydatid cysts of the spleen are actually rare in America is justified.

#### ABSTRACT OF CASE REPORTS

I append here brief abstracts of 50 cases of hydatid cysts of the spleen. The first 17 are historical and are here included because they are constantly quoted, often without chapter and verse, and are not particularly easy of access. The rest are of comparatively recent date i e. since 1900.

CASE 1 1850 Degalle. Male age 22 diagnosis "cold abscess." Opened by caustic potash. Death days later from infection. An example of the old method of treatment.

CASE 2 1863 Skoda. Male age 46. Severe pain necessitated the frequent injection of morphia. Puncture. Hooklets demonstrated. Severe hydatid reaction. Two subsequent punctures with injection of iodine. Recovery. A happy result from treatment which is now obsolete.

CASE 3 1870 Durozier. Spleen one vast hydatid cavern, cyst had opened into bronchus (compare cases of Debooe, Lafargue, and Malaveres and Martin).

CASE 4 1876 Brault. Male, age 57. Severe intractable diarrhoea and death. Postmortem, enor-

mous hydatid cyst of spleen, full of degenerated daughter cysts, opening into transverse colon. Adherent to liver. An example of hydatidogenic."

Case 5 1885 Bism (Mortureux obs 1) Enormous hydatid cyst of spleen. Symptoms of intestinal obstruction. Full of daughter cysts. Marsupialization. Two months later fistula persisted. This man lived and slept with cats and dogs.

Case 6 1884, Boudet Boy, age 1. Three years mild icterus. Spleen reduced to shell, pulp practically absent and replaced by the hydatid cysts. Mesenteric and prevertebral lymphatic glands enormous. Here the extensive development of the abdominal lymphatic ganglia apparently supplemented the splenic functions.

Case 7 1885-885 Dieulafoy Male age 43. Spleen free from adhesions and low in abdomen. Enormous hydatid cyst of spleen pushing up the diaphragm. Cyst adherent to spleen only. Spleen marsupialization. Recovery. This case was just a splenic and consequently the spleen was respected. An example of the ascending type.

Case 8 1885-1885 Dieulafoy Upper limit of dullness at fifth rib instead of third, as in Case 7. Enormous cyst of spleen in a male whose general condition was good. Splenectomy (see an example of the descending type).

Case 9 1885-1885 Case of Arnould, cit Dieulafoy. Illustrates the compensatory hypertrophy which obtains in the splenic pulp in such cases. (Compare cases reported by Robert, Javie and Snegulrew.)

Case 10 1885 Laloué Man, age 6. Part of cyst herniated through abdominal wall, skin red over prominence. Incised, clear fluid and daughter cysts escaped. The tumor the size of a fetal head, reached down to the iliac fossa. Incision and drainage. Two communicating apartments in cyst. This cyst would shortly have burst externally.

Case 11 1890 Hope Grant, female at age of 18 had a large splenic tumor. At the age of 30 "it" chamberful of watery fluid came away and the tumor almost disappeared. Ten years later four cysts were passed per rectum still small splenic tumor.

An example of hydatidogenic.

Case 12 89 MacLaren Enormous hydatid cyst of spleen. Tapped. Cyst contained 2 pints of fluid in which scolices were demonstrated. Four weeks later operated in two stages. No bleeding. Membranes removed and cyst drained. Depth for long time more than 1 inches. Sinus remained months later. No anesthetic at second stage of operation, as incision of spleen or liver is painless. Also no danger of dissemination.

Case 13 893 James Oliver Female from New Zealand. Cyst adherent to anterior abdominal wall from pubes to 1 inches above umbilicus, and attached by a pedicle to lower border of spleen. The shape of a Florence flask. Contained many daughter cysts. A juxta-splenic cyst.

Case 14 1894 Trinker Female, age 46. General debility and night sweats. Children 13 mm

carriages. Splenic tumor extended 35 centimeters below the ribs. Mental derangement 6 months. Tumor mobile like those of omentum. Hydatid fremitus. Operated upon in two stages. No succinic acid or sugar. Many daughter cysts. Drainage. Infection. Urticaria. Three months later fistula persisted. Illustrates the disadvantage of marsupialization.

Case 15 1895 Casanova Female, age 37. Splenic tumor 4 years. Cyst adherent to omentum and full of daughter cysts. Cyst sprung from left border of spleen. Incision resection of part of sac and marsupialization of rest. Discharge caused intense skin irritation. Fistula 3 years and 4 months afterward. Illustrates the poor results of marsupialization.

Case 16 Snegulrew (Moscow) 1895 A juxta-splenic cyst. Splenic artery wounded during excision and, after a jet of steam had failed to stop hemorrhage, splenectomy had to be resorted to.

Case 17 1897 Roche. Tumor present in region of spleen after a violent fall in 1880. Symptoms of rupture appeared but soon cleared up. They recurred in 1896. Dyspnea. Rupture. Hooklets demonstrated. Severe reaction and urticaria. Marsupialization and cyst packed with gauze. Urticaria and suppuration followed with discharge of daughter cysts. Recovery. Illustrates the influence of a *locus minoris resistendi*, which has been mentioned by Verneuil, Danlos, Kummerson, Magdalen, Leprieux and Verneux.

#### CASES OF HYDATID CYST OF THE SPLEEN THAT HAVE BEEN REPORTED SINCE 1900

Case 18 T denat (Montpelier) 90 Shepherd, age 13. Splenic tumor size of two fists. Spleen weighed 85 grams and contained no hydatid cysts. Some fibrosis. Splenectomy. Recovery.

Case 19 Villar 1903 Patient had been operated on 1900 for hydatid cyst of liver. Now has multiple abdominal cysts, two in spleen and one in pancreas. Operation excision of a hydatid cyst of mesentery and omentum. Through separate pericostal incision spleen as exposed, adherent to diaphragm. Section of splenic vessels and subtotal splenectomy. Small shell adherent to diaphragm left. Marsupialization of small remnant of splenic cyst. Pancreas, capitonnage of DeBor. Discharged cured month later.

Case 20 F R Seagar 903 Boy age 1. Mass in region of spleen 4 months, larger after meals and at night. Complained of stitch. Operation two-thirds of anterior surface of spleen occupied by shining ellorish tumor. One pint of clear fluid drawn off. Thick cyst wall shelled out. No daughter cysts were found. Marsupialization as done. Recovery.

Case 21 Delors and Paolet 1903 Female age 5. Hydatid cysts of spleen, pelvis, and omentum. Splenectomy. Recovery. Spleen weighed 90 grams. Hooklets demonstrated.

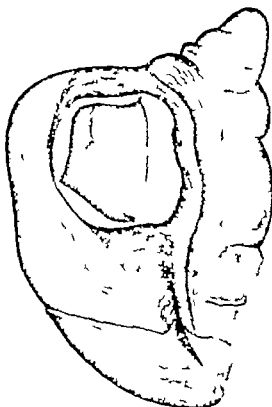


Fig. 4. Hydatid cyst of the spleen showing daughter cysts *in situ*. (From *Hydatid Disease* by James Graham.)

CASE 5 Cerrulo 1904 Solitary hydatid cyst of spleen in female from Palermo age 29. Three months pregnant. Tapped. Recovery.

CASE 3 Cerrulo Boy age 3 who recovered from an hydatid cyst of the spleen that had been tapped.

CASE 24 Scherb (Algiers) 1904 Indigenous male with enormous tumor of left flank which had been diagnosed as malarial spleen. Practically no symptoms except compulsory left decubitus. Eosinophilia 6 per cent. Slight fever indicating infection. Scherb diagnosed hydatid cyst of the spleen of sacroding type. Operation incision and lipa sewed closed, 12 litres of fluid evacuated. resection of tenth rib and suture of diaphragm to thoracic wall. Through-and-through drainage. Recovery.

CASE 3 N. Giannettasio 1905 Primary echinococcus cyst of malarial spleen in a female age 38. Splenectomy. Spleen weighed 850 grams and contained 6 litres of pus. Recovery.

CASE 26 L. Grabowsky 1905 Female, age 4. Pain and swelling under left costal arch 6 months. Urticaria. Tumor size of baby's head. No daughter cysts. Splenectomy. Recovery. Typical lamina

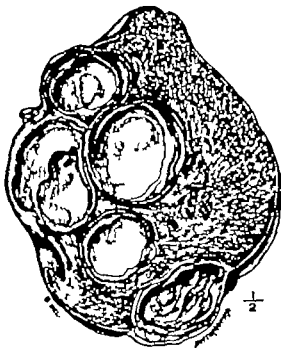


Fig. 5. Hydatid cyst in hilum of spleen (Museum of St. Bartholomew Hospital). (Taken from *T. mors Inusitata* and *Malignant* by St. J. in Bland-Sutton.)

tion of cyst wall. Postoperative increase of leucocytes from 8,000 to 20,000 and of red blood cells by 500,000. proportion normal gain on tenth day. Grabowsky likens the hydatid urticaria to that produced by the injection of animal serum. Advances splenectomy and notes that the blood changes thereafter are temporary only.

CASE 7 Maurice Warot (Algiers) 1905. Male age 42. Hydatid cyst in ectopic spleen. Operation incision removal of membranes and suture without drainage. Most of spleen destroyed. He prefers simple incision and suture without capsulotomy, thinks that marsupialization should be reserved for suppurating cysts, and advises splenectomy only where spleen is destroyed by cyst, free from adhesions, and with clean contents.

CASE 28 T. G. Wilson (Australia) 1905. Female, age 39. Pain in left side since a few weeks before last confinement (twins). Abdominal swelling which appeared to spring from pelvis. Fluid thrill. Diagnosis, ovarian cyst. Operation, hydatid cyst of spleen which had become adherent to pelvic brim and burst during operation. A second (subcostal) incision made and 4 pints of clear fluid evacuated and membranes removed. Redundant capsule cut away and remnants sewed to parietal incision which was closed in layers. Small drainage tube for 24 hours. Discharged cured in 3 weeks.





Fig. 6 Solitary hydatid cyst of the spleen, containing degenerated vesicles and membrane. From woman aged 54 who died from bronchitis. No symptoms during life to draw attention to the spleen. Specimen in the Museum of St. Bartholomew's Hospital. (After Bland Sutton.)

Notes chronicity of stomies after marsupialization, and regards the above method, advocated 30 years earlier by Thornton, as the best one for clean cases.

CASE 29 S. von Schmarda 1906 Butcher age 37 Hydatid cyst size of man's head in spleen, and one size of fist in left lobe of liver Splenectomy Recovery

CASE 30 C. Symington 1907 Reports an hydatid cyst of the spleen the size of a billiard ball, in a native suffering from tuberculosis

CASE 3 A. Martin 1908 Female, age 3 Fairly movable tumor in region of spleen omental cyst suggested Operation disclosed pedunculated hydatid cyst attached to the spleen.

CASE 3 A. Martin Male, age 36 Increased eosinophilia Hydatid fremitus Operation four hydatid cysts 1 spleen and five of omentum Splenectomy Death from shock same night Post mortem, hydatid cyst found thoracic cavity

CASE 11 A. Martin (courtesy of Raymond) Feather-maker age 48 Hydatid cyst of spleen Splenectomy diaphragm torn in detaching spleen which was completely destroyed, pneumothorax, death Illustrated danger of splenectomy in presence of dense adhesions

CASE 34 A. Martin (courtesy of Fauchet) Man, age 38 Tumor size of adult's head, diagnosed as hydatid tumor. Eosinophiles increased Operation hydatid cyst of spleen enucleated Two years later splenectomy Recovery

CASE 35 A. Martin (courtesy of Lucas Champlondre) Male, 35 from colonies Symptoms of tuberculosis Hard abdominal tumor Operation Hydatid cyst of spleen full of daughter cysts Mar supuration, as patient ery anemic Recovery

CASE 36 A. Martin (courtesy of Jönnesco) Man, age 55 Puncture, hooklets found Operation cystic tumor adherent to spleen Marsupialization Recovery

CASE 37 Case reported by the Australian correspondent of the *Lancet*, 1909 A middle aged man got into a fight and died next day Postmortem, a ruptured hydatid cyst of the spleen was found Spleen reduced to a mere shell No symptoms during life

CASE 38 J. B. Christopherson 1909 Nubian female from Egypt, age 30 Operation hydatid cyst of spleen, broad ligaments, omentum and mesentery Daughter cysts and hooklets Contracted disease in Egypt

CASE 39 D. Blood 91 Country female, age 48 Tumor noticed in left hypochondrium after childbirth, but no symptoms for 7 years, then high fever and epigastric pain developed Pronounced eosinophilia Operation non suppurating multilocular hydatid cysts in spleen, which was adherent to diaphragm, colon, and the walls of the vena cava Splenectomy Recovery

CASE 40 Pieri and Poucel 1913 Female, age 35 Diagnosis, hydatid cyst of kidney Complete fixation test positive Operation hydatid cyst in inferior pole of spleen Resection and spleen sutured Recovery Advocates marsupialization in two stages

CASES 4-42-43 B. K. Finkelstein (Caucasus) 1914 Reports three cases of echinococcus cysts of spleen, all males Two recovered and one died (shock) Two splenectomies and one splenotomy Sixty six personal splenic operations from 1903 to

1913. In 1909 reported 46 splenectomies with 8 deaths H. thinks splenectomy should be done only when cysts are enormous, when there is extensive destruction of the spleen, and when the spleen is displaced and the pedicle twisted

CASE 44 James Sherren 1914 Female age 5 Symptoms of tubercular peritonitis with urticaria in 1909 Splenic tumor 1903 Eosinophiles 15 per cent Operation large white unilocular cyst on gastric surface of lower pole of spleen Adhesions to liver abdominal wall and diaphragm All other abdominal organs normal Splenectomy Recovery Spleen weighed 3 pounds, 4 ounces and contained 100 cubic centimeters of clear fluid in which scolices and hooklets were demonstrated The ascites, diarrhoea, and urticaria in 1909 suggest rupture of the cyst

CASE 45 A. Cardarelli 1914 Female age 4 Tumor coming from under left costal margin, ad-

berent around umbilicus, moves with respiration. Temperature normal no icterus. Complement fixation test negative. Slight eosinophilia. Patient well except for pain. Aspiration of 800 cubic centimeters of limpid fluid containing some albumin. Notes that hydatid fluid is free from albumin except near or after death of parasite—the cyst lives on albumin. Quotes Calabrese's case which was aspirated monthly for a year with resulting cure. Advises aspiration with subsequent incision if cyst suppurates. Quotes cases proving that hydatid fremitus is non-pathognomonic of hydatid cysts.

CASE 46. Zwirn. 1921. Female, age 55. Splenic tumor 7 years. Now fills left half of abdomen. Very little pain. Operation. Sprengel incision. Enormous hydatid cyst of the spleen containing 4 litres of fluid and many daughter cysts. Lavage with ether and tight closure. Attached to abdominal wall. Wound healed in 10 days. Advocates total immediate closure. Two months before operation this patient had evacuated, by vomit, clear salty fluid and subsequently pus.

CASE 47. Borset. 1921. Female, age 60. Born in Sicily but had lived long in Marseille. Postmortem, a large hydatid cyst of the spleen was found projecting from the inner surface of the spleen occupying its entire thickness, adherent to kidney and diaphragm. Fluid clear. About 15 daughter cysts, the size of grape seeds. Notes the resemblance here to the kysts emerjaunt of Mabit.

CASE 48. E. Zak. 1923. Female, age 19. Primary splenic cyst with multiple echinococcosis of abdomen and lungs. Anaphylactic symptoms after two mis-carriages. Embryos demonstrated in blood stream. Hydatid thrill.

CASE 49. Lubbers and Noordenbos (Holland). 1922. Male, age 26. Splenomegaly ascribed to malaria. Splenectomy. Hydatid cyst of spleen of ascending type, hardly any splenic tissue left. Death in 24 hours. Notes that prognosis after splenectomy is more favorable in the descending type of Dieulafoy. Also that the disease is rare in Holland.

CASE 50. Tadden. 19. Patient had large hydatid cyst in pelvis, one peritoneal cyst and one in the spleen. Operation. Captonnage. Avoided marsupialization as exposing to secondary infection and postoperative hernia. Advises that no drainage tube ever be used that the formulae of Deve be adopted in splenic as in liver cysts, and thinks that partial resection of the sac and partial captonnage are dual antagonists.

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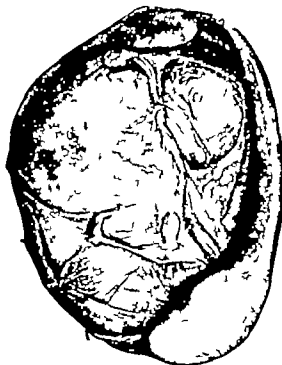


Fig. 7. Hydatid cyst of the spleen.

The patient was a woman, age 5, on whom a successful splenectomy was performed. The specimen is now in the Museum of the Royal College of Surgeons, London. (After Sherren.)

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Fig. 1. Pleurisy of the right hilum region. examination made 8 day after spontaneous rupture of the abscess September 9.



Fig. 2. Same case as figure 1. Note decrease in size of right hilum opacity. Patient much improved although still expectorating March 7 93.

The above symptoms and conditions continued with some increase in the non productive cough and slight increase in temperature until the afternoon of September 3 when, after slight chill, his fever went to 104 degrees. About 10:00 a.m. the next morning, after very prolonged coughing spell, he felt something going in his chest and he coughed up about ounces of a brownish foetid fluid. For the next few days more of this fluid was coughed up and the odor appeared more pronounced, the fluid becoming thicker and more grayish. The temperature dropped to 100 degrees where it could remain so long as the foetid fluid was coughed up. When it could not be expectorated, the fever would rise after a slight chill.

The patient was kept confined to his bed for weeks, positions favoring drainage. After this time he was allowed up. A sputum test was made for tuberculosis and was negative. The Wassermann reaction was also negative. On September 31 he had his first X-ray examination, the report of which was as follows:

*Stereoscopic and fluoroscopic examination of chest.* Left lung negative. Right lung there is an irregular shaped opacity situated in the right hilum region which cannot be separated from the hilum itself but is not sharply defined. The lung itself does not light up as well as the opposite side although the parenchyma appears negative. There is some lagging of the right diaphragm. The cardiac shadow is not

displaced and is within normal limits. Conclusion: This is one of those comparatively rare cases of pleurisy of the hilum region in the hilum open space of the pleura. They frequently rupture and empty to the bronchi causing a sudden appearance of purulent expectoration with extreme foetid breath.

Following the X-ray examination the patient continued to improve generally. Aside from an occasional fleck of blood in the sputum there was no frank bleeding until the evening of October 6, when, after an unusual hard coughing spell he suffered a violent hemorrhage losing about 300 cubic centimeters of blood. From this date to November 13 there occurred 3 separate and more or less severe hemorrhages, the largest being about 600 cubic centimeters in amount.

On November 23 another X-ray examination was made and the right hilum shadow appeared smaller. The patient showing considerable clinical improvement in the interval, although he was still expectorating.

The treatment in this case was limited to the symptomatic and medicinal.

Encysted empyema may develop in either hilum region and may be localized in front of or behind the hilum. It is due to an infection the origin of which is usually either bronchial glandular or esophageal. If sufficiently firm





Fig. 3. Same case as figures 1 and 2. Not still further decrease in size and density of right hilum shadow, also the calcifications present. Patient entirely well June 5, 1913.

adhesions have had time to develop early the empyema may remain localized in the hilum, develop there and without progressing undergo resolution being evacuated spontaneously through the bronchi and rapidly cured. At other times it remains localized at first in the hilum and then affects the interlobe secondarily becoming transformed into an interlobar pleurisy and still later may affect the entire pleural cavity. Therefore hilum pleurisy may precede any form of pleurisy, whether total interlobar or mediastinal. The true hilum phase is usually short and gives only slight local symptom and may easily pass unnoticed. Roentgen examination alone detects these localizations, being shown by an opacity the appearance of which depends on whether the examination is made before or after the evacuation into the bronchi. Before evacuation a very distinct opaque shadow with well marked outline is

seen. After evacuation the contour is less distinct being sufficient however to attract attention to the hilum.

In the case reported if an examination had been made before evacuation we would probably have seen the interlobar phase the opacity being much larger and more sharply defined. Since the examination was made 18 days after the first evacuation the opacity was comparatively small and not so opaque or sharply defined. The unusual symptom of this case was the marked recurring pulmonary hemorrhages some weeks after the primary rupture of the abscess.

#### CONCLUSION

Pleurisy of the hilum region can be successfully diagnosed only by a combination of a careful history with a roentgenological study. Without a careful history the increased hilum shadow might be interpreted as a mediastinal tumor, glandular masses, or limited pulmonary lesion. Because of the extreme fetid odor such cases may simulate pulmonary gangrene. However in pulmonary gangrene the fetid odor precedes the expectoration, stethoscopic signs are more important and the general condition is more serious.

NOTE.—After this paper was read another X-ray examination was made on March 7, 1913, and although the right hilum was still more prominent and denser than normal it was distinctly smaller than at the previous examination. In the interval the patient had been attending his business, enjoying fair health but continued to expectorate daily.

The last heard from him was on June 24, 1913, when he reported that about March 7 he had had three pulmonary hemorrhages, each of several tablespoonful, making him very weak. He had continued daily expectorations but in gradually decreasing amounts until about 6 weeks ago when they ceased. Since then he has felt free in his work, regained his weight and strength. Another X-ray examination was made at this time and the right hilum shadow showed marked decrease in size and density, being practically normal in outline although still somewhat larger than on the opposite side. The hilum shadow appeared entirely due to fibrous tissue and much calcification. The patient also reported that several months ago, less expectorating considerably, he consulted a physician in another city, here he had moved. This physician pronounced him tuberculous and advised him to go to sanatorium. A sputum examination, as made but proved negative for tubercle bacilli. The subsequent X-ray examination and history of the case, however, showed no evidence of pulmonary tuberculosis.

# LESIONS OF THE URETER WITH SPECIAL REFERENCE TO OBSTRUCTION AND INFECTION

A FACTOR IN THE DEVELOPMENT OF CERTAIN FORMS OF NEPHROPATHOLOGY<sup>1</sup>

BY CLINTON K. SMITH, M.D. KANSAS CITY, MISSOURI

THE general idea of ureteral lesions until recently has been extremely vague and in those instances where some idea of ureteral pathology did exist not much importance has been attached thereto. Of late however this previous attitude of indifference has given way to an increasing tendency to regard the status of ureteral drainage as the key to the solution of a large percentage of nephropathic problems.

In this discussion I wish to include only the common types of obstruction and ureteral infection. Ureteral stone, tuberculosis and cancer I shall not include; they are each distinct and separate problems.

With this limitation in mind I shall discuss the several phases of ureteral disease, and present brief case histories and roentgenographic illustrations which I consider representative of the common types of ureteral lesions, showing, in contrast early and late involvement.

For the purpose of this discussion it is convenient to classify ureteral lesions as obstruction or infection according to the predominant pathology.

## URETERAL OBSTRUCTION

Under this classification I shall include all forms of ureteral narrowing from the congenitally small ureter to the definite formation of connective tissue stricture. I have chosen to consider obstruction first as I am of the opinion that obstruction, as above defined is the underlying cause of most, if not all ureteral and renal infection.

It has long been a recognized fact that bladder stasis is the most frequent underlying cause of cystitis. It seems equally consistent that a known stasis in the upper urinary tract should produce similar problems.

*Etiology and types of obstruction.* From the standpoint of etiology the obstruction is either congenital or acquired. While according

to the factors in its development, it is either intrinsic or extrinsic.

In considering types of obstruction one must keep in mind three main conditions. The ureter of abnormally small caliber either in whole or considerable part in which no definite band or constriction is present, the definitely strictured or constricted ureter in which a definite band or limited area of narrowing exists and the ureteral kink.

*Ureters of small caliber.* Of the etiology in this group there can be no question. It is congenital.

In defining this group it is difficult to say just what should be considered the normal caliber of a ureter but it should be able to conduct the urine from the kidney to the bladder without allowing development of renal stasis.

There is no doubt that in many instances ureters of very small caliber are able to accomplish this under normal conditions but when something occurs to produce congestion and swelling of the ureteral mucosa ureteral colic and renal pain supervene. As a usual thing, these symptoms promptly disappear in the early stages after the passage of a bougie or a catheter (Case 1, Fig. 1).

Ureters of this type are prone to become involved in infectious processes, with attendant anatomical changes (Case 2, Fig. 1).

*Stricture.* In defining stricture, I believe that all narrowing involving a definite limited area should be included, particularly narrowing sufficient to produce stasis. Most strictures are encountered at one of three points in the following order of frequency: ureterovesical junction, ureteropelvic junction, and the iliac crossing.

There is one other point at which stricture has been more recently recognized and that is at the broad ligament in the female and at the vaso-ureteral crossing in the male.

*Etiology.* In 1910 Bottomley (1) published a report of 56 cases which he concluded com-



Fig. 3. Case 3. Abnormally narrow ureters. Easily obstructed. Arrows mark ends of ureteral catheters. No evidence of infection. Tracings indicate outline of upper ureters.

Fig. 4. Case 4. Dilatation entire ureter, infective process. Ureteritis of several years' standing.



Fig. (left). Case 4. Structure of the ureter, anal portion. General dilatation above. No evidence of infection.

Case 4. Structure of the ureter, anal portion. In section of several years' standing. Marked dilatation.

prised the cases of ureteral stricture appearing in the literature up to and including his publication. These cases ranged in age from fetal life to 50 years, and analysis was either by autopsy findings or by operation. He concluded from analysis of the cases, including the cases upon which he had personally operated that the condition was congenital. Botkinley's report was significant in that his opinion was based on examination of specimens removed at operation or autopsy.

The most recent contribution to this phase of the subject is by Brown (2) of Detroit, in a comprehensive postmortem study of the urinary tract of 80 unselected cases in fetuses and young infants. Of these 20 per cent showed malformations of the upper urinary tract involving the kidney, hydronephrosis, etc. and 11.25 per cent involving the ureters. In conclusion he stated that in his opinion the kidney manufactures urine months before maturity of the fetus, and probably in con-

siderable quantity. Also the fetus may develop a toxemia from retention in its blood stream of kidney products independent of the blood stream or kidney efficiency of the mother."

If we keep in mind the complicated fetal development of the genito-urinary tract with the evolutionary opening of the ureter into the bladder after its origin from the Wolffian duct and the formation of the renal pelvis from the dilated upper end of the ureteral canal by contraction at the point of branching, it is not difficult to understand that any derangement in the evolutionary development of these structures may cause ureteral malformation. In the studies previously referred to in several instances the ureter had altogether failed of opening into the bladder and in others the openings were of hair-like caliber.

In contrast with the methods of study of earlier observers, whose opinions were based upon operative evidence, our conclusions today are largely a result of clinical observation in conjunction with cystoscopic procedure. While our ability to deal with these cases by cystoscopic methods has deprived us



Fig. 3 Case 5. Structure of the ureter. Iliac crossing. No evidence of infection.  
 Case 6. Structure of the ureter. Iliac crossing. Infection of several years' standing. Note the marked dilatation of ureter above the obstruction.



Fig. 4 Case 7. Structure of the ureter. Ureteropelvic junction. No evidence of infection. Small dilatation.  
 Case 8. Structure of the ureter. Ureteropelvic junction. Considerable dilatation with infection. Several years standing. Also constriction of ureter region of the broad ligament.

of the opportunity of cutting down on many of these lesions, still as modern urological methods are becoming better known we are enabled to see these cases early and note the changes which occur whereas the earlier observers saw only the end-results.

Hunner (3) is of the opinion that stricture is the result of focal infection. With this main contention I am in accord, but I believe that congenital malformation with disturbed ureteral function and stasis is the primary factor which defines the site of metastatic involvement which may well result in the formation of connective tissue and further narrowing. In this connection, the point which I wish to emphasize is that although in many instances

infection appears to be the immediate problem, yet, from a therapeutic standpoint we must keep in mind the congenital aspect and establish free ureteral drainage.

Finally although the etiology must be in doubt in many cases when seen in the later stages, wherein infection and extensive pathological conditions obtain, still I am of the opinion that if these cases could be seen early congenital ureteral pathology could be demonstrated in most instances. Cases 3 and 5, Figures 2 and 3 are representative of congenital stricture situated at the ureterovesical junction and at the iliac crossing, without infection. Cases 4 and 6, Figures 3 and 3 show the changes which occur with infection. Cases 7 and 8, Figure 4, likewise are representative of the early and late appearance of the renal pelvis with stricture of the ureter at the ureteropelvic junction.



Fig. 5. Case 9. Kink, upper third of ureter. No evidence of infection.  
Case 10. Kink, upper third of ureter. Infection with extensive anatomical change.

**Stricture from extrinsic causes.** Stricture due to extrinsic causes is confined almost entirely to the lower ureter. The proximity of the lower ureter to the tip of the seminal vesicle, and the extreme frequency with which the vesicle is involved in inflammatory processes, provides a situation in which the ureter might well become frequently involved in this process. The importance and relative frequency of this lesion has been pointed out by Mark (4) Herbst (5) and others.

A somewhat analogous situation frequently obtains in the female in the region of the broad ligament.

**Ureteral kinks.** The ureteral kink, I believe is primarily a congenital affair probably an other phase of mal-development—a vestige of the *sausage-like fetal ureter*. Such kinks occur almost exclusively in the mid or upper portion, and according to personal observation, are usually associated with stricture. The sagging of the kidney seen in many of these cases is undoubtedly secondary to enlargement as a result of the ureteral stricture. These kinks usually are discovered during the course of a urological examination made to deter-

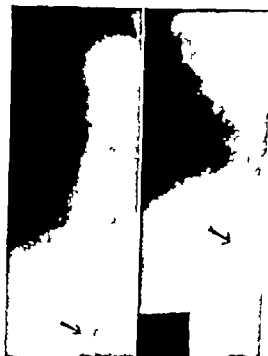


Fig. 6. Case 11. Ureteritis involving the lower portion of the ureter. Characterized by extreme dysuria.  
Case 12. Ureteritis involving greater part of the ureter. More marked in the midportion. No dysuria.

mine the cause of ureteral colic or renal pain, and I am of the opinion that the stricture is the pain producing lesion rather than the kink, excepting perhaps in those cases in which the kink has become fixed through inflammatory reaction. Cases 9 and 10 (Figure 5) are representative of early and late phases of ureteral kink.

**Diagnosis of obstruction.** I cannot too strongly emphasize the importance of knowing the condition of the ureter in dealing with lesions in the upper urinary tract. The not ably poor results obtained by indiscriminate renal fixation for hydronephrosis are mostly due to the application of treatment to the result rather than to the cause of the condition. I recall one such case in which I had occasion to dilate the ureter with complete and immediate relief of pain after fixation had failed to influence the symptoms (Case 8, Fig. 4).

In dealing with infections in the upper urinary tract, it is of the greatest importance to know to what extent ureteral obstruction is responsible for the conditions which foster the development of infection. How illogical it seems to wash out a renal pelvis through a small ureteral catheter and depart leaving untouched the ureteral obstruction which is often the real factor!

Again, in so-called "essential" renal haematuria what urologist has not seen these cases in which he could discover no definite cause for the bleeding but in which it subsided after ureteral catheterization?

It is therefore not alone sufficient to know that we are dealing with an enlarged renal pelvis, or renal infection or renal bleeding. We should know to what extent faulty ureteral function is primarily responsible and correct this, if we would really solve the problem. In treating the average case of pyelitis, if a choice had to be made between a No. 5 catheter with pelvic lavage or a No. 10 bougie, without lavage I should choose the latter.

There are two methods of demonstrating ureteral obstruction: by the bulb catheter or bougie and by ureterography. A combination of both is desirable in order to obtain all possible information. When used in combination we are able to know whether there is obstruction by the hang of the bulb and the ureterograph gives us an idea as to the type of obstruction and whether or not anatomical changes have occurred.

#### URETERAL INFECTION OR URETERITIS

While ureteral stricture has been a fairly well recognized pathological entity for a considerable number of years, ureteritis is still almost unknown, or is regarded with extreme indifference except by a limited few. Even textbooks on urology with few exceptions, either omit the subject altogether or dismiss it more or less as a curiosity. It is a well known fact however to those who have had the opportunity of making a careful study of the ureter that ureteritis is one of the common causes of abdominal or pelvic pain and dysuria, especially in women. Some of my most extreme cases of dysuria have been due to inflammation of the lower ureter.



Fig. 7. Case 3. Section through the cortical and medullary portion of kidney 4 days after release of complete ureteral block of 8 days duration. There are no pathological changes with the exception of occasional areas of cloudy swelling involving the descending loops.

Infection is the immediate cause and is either a lymphatic extension—the condition is frequently associated with chronic infections of the urethra—or is metastatic from distant foci. Although infection is the immediate cause of ureteritis I am of the opinion that obstruction and stasis are remote factors. At any rate from a therapeutic standpoint these cases respond to dilatation of the ureter below the lesion. In this connection it may be objected that certain cases of ureteral infection present the picture of a wide open-mouthed ureter with general dilatation. Some of these cases are undoubtedly due to congenital absence of the ureterovesical valve allowing regurgitation of the bladder urine which again brings us back to the question of stasis.

In the majority of instances ureteritis occurs in the lower ureter and is usually associated with a high degree of pain and dysuria, due no doubt to the action of those muscle fibers of the trigone which extend upward along the ureter in tugging on this anchorage during the muscular contraction of the trigone in drawing open the bladder outlet (Case 11, Fig. 6). Ureteritis occurring in the mid ureter however is not uncommon. In these cases, pain and tenderness along the course of the ureter is usually the outstanding symptom. In other

cases the entire ureter is involved exhibiting symptoms of both pain and dysuria. From an anatomical standpoint the infected ureter eventually becomes thin loses elasticity and the whole becomes dilated and elongated. It resembles somewhat a piece of old flaccid rubber tubing. Case 12 Figure 6 and Case 2 Figure 1 are typical of ureteritis occurring in the above mentioned localities.

#### EFFECTS OF OBSTRUCTION AND INFECTION

Study of the effects of ureteral obstruction affords perhaps the most interesting phase of urology.

It must occur to anyone who attempts an analysis of the predominating tendency of renal infection to occur unilaterally that some defining factor must be operative in preparing a soil more favorable for this development, on the one side rather than on the other and according to the generally accepted idea this factor is urinary stasis. The most outstanding example of this is the well known right sided occurrence of renal infection in pregnancy.

*Immediate effects and symptoms.* The immediate effect of obstruction is urinary stasis. This stasis is transient or persistent, according to the character of the obstruction. In this connection can be seen a definite reason for the circular muscle reinforcement between portions of the ureter at the ureteropelvic junction and between the major and minor calyces a provision confining the stasis to the immediate segment above obstruction and thus protecting the excreting structures of the kidney from back pressure till the last possible moment. The immediate symptom of obstruction is pain. As soon as stasis develops involving either the ureter or kidney pelvis (which as previously stated should really be considered a part of the ureter) a stimulation of muscular contraction occurs in an effort to get the accumulated urine to pass outward. But not all phases of obstruction exhibit this symptom. It is known that pain associated with obstruction is due to muscular spasm, and that pain does not occur in marked dilatation after muscular tonicity is lost.

This symptom is present therefore, in the earlier stages of obstruction, and is either of the acute, intermittent colic like type or the

persistent, aching type according to whether the development of the obstruction is acute or insidious. It is interesting to speculate regarding the pain period in some of the cases of large dilatation in which the patient recalls no experience of pain.

Possibly the development has been so insidious in nature that little attention was given the pain, or it may have been ascribed to digestive disturbance. Going further back and referring to the study of Brown in which he concludes that the urinary function is operative in fetal life perhaps these dilatations passed through the pain period at that time or in early life when abdominal pain is usually interpreted as intestinal colic.

*Remote effects.* The remote effects are both anatomical and functional. Their relationship is so closely interwoven that a combined consideration of the pathopathology seems most practical.

If the obstruction is intermittent and relatively transient, no anatomical change takes place and consequently there is no permanent damage. From a clinical standpoint it is difficult to estimate the duration of obstruction necessary to produce anatomical changes. It has been shown, however experimentally that to accomplish this, rather persistent obstruction is required. Infection in all probability occurs more readily in proportion, in those cases of acute or intermittent obstruction associated with acute hyperemia in which the mucosa is thrown suddenly into a high state of congestion and likewise subsides more acutely with the passing of the obstruction. Those cases of pyelitis which clear up after one or two ureteral catheterizations and lavage are examples. The passage of the catheter establishes sufficient drainage to remove the cause of the congestion, and the infection is then readily controlled.

*Results of obstruction on the kidney.* This is the all important phase of the whole proposition. Studies of unusual import, both experimental and clinical have recently been reported. With acute obstruction there is an acute decrease in renal function, ranging in degree to complete cessation with complete obstruction. With the release of the obstruction, if within certain time limits, not only does func-

tion return but a temporary supernormal function occurs, such as is seen in some cases of hydronephrosis in which the patient passes enormous quantities of urine during the first hour after release of the obstruction an amount entirely out of keeping with the capacity of the renal pelvis, as has been demonstrated in these cases. Acute obstructions, then, which are not sufficiently permanent to produce anatomical changes do not cause permanent loss of renal function. Even complete obstruction if of only a few days duration does not result in permanent damage. From clinical observation, I am of the opinion that the disastrous end results, pyelonephrosis, etc. which we see with ureteral obstruction, are more often seen with the partial, persistent type.

From experimental studies Hinman (6) has reported some interesting findings. He was able to release a complete ureteral block of 14 days or less, and with nephrectomy of the opposite side get complete repair in the kidney of the blocked side. Crabtree (7) has reported clinical bilateral block of 4½ days duration without apparent damage. Personally I have seen a prompt return of normal function following the release of an unilateral block of 8 days duration (Case 13 Fig 7).

When obstruction is of sufficient duration to cause anatomical changes, the situation is far different. Hinman's (6) experiments show that when damage once occurs, the damaged kidney if left to its own devices, undergoes a gradual persistent atrophy and that hypertrophy and compensatory function gradually develops on the opposite side. But if the opposite side is then subjected to embarrassment by partial persistent obstruction of the ureter repair takes place in the damaged side, and if the embarrassment is continued atrophy occurs on that side while the previously damaged side continues to complete repair. This phenomenon he calls renal counterbalance. This experimental evidence appears to coincide with the clinical observations of Crabtree (7) who in a study of ureteral obstruction with hydronephrosis which occurred during pregnancy observed that the capacity of some of these renal pelvis which stood at 200 or 300 cubic centimeters at that time, promptly decreased to about 15 cubic centimeters, or

approximately normal following the termination of the pregnancy. But subsequent observation disclosed the fact that these pelvis soon underwent progressive dilatation, and that the process in some cases ultimately terminated in pyonephrosis.

It would appear from the foregoing evidence that when once permanent damage has occurred, the tendency is for the healthy kidney to do more and more work and the diseased kidney to accomplish less and less, progressing toward permanent atrophy and total loss of function. And the experiments of Hinman tend to show that the outlook for repair is dependent upon shifting more work to the diseased side by creating a less favorable outlet on the opposite side. So far as I am able to learn this plan has not been applied directly to clinical cases. However the plan of maintaining supernormal ureteral drainage on the diseased side may accomplish similar results. This plan I have followed in several cases, and while the clinical picture is satisfactory sufficient time has not yet elapsed to allow conclusion as to the final outcome.

#### CASE REPORTS

CASE 1. March 14, 1936 G. V. female, age 44 complained of pain of sudden onset, sharp lancinating character beginning in the left loin and extending downward along the course of the ureter. There was hematuria, but no dysuria.

*Urological findings:* No evidence of obstruction could be demonstrated in either ureter except a general small caliber of both ureters. The urine was free from pus or other evidence of infection. Catheterization of the ureters reproduced the previous symptoms. The left ureter was dilated to No. 7 F on two occasions. There was no recurrence of symptoms on that side. One year later the patient had a similar attack of pain on the opposite side, which responded to similar treatment.

The outstanding feature in this case was the typical ureteral colic with no demonstrable obstruction of the ureter except the general small caliber.

CASE 2. June 4, 1930 C. K. male, age 39 complained of intermittent attacks of dysuria and hematuria, which began about 3 years previously. There had been slight persistent frequency.

*Urological findings:* The uroteropyelogram on the right disclosed a generally dilated and tortuous ureter. The urine contained pus and red blood cells. The symptoms gradually subsided with instillations of a 2 per cent silver nitrate into this ureter at 5 to 10 day intervals. This was a general dilated condition of the ureter undoubtedly due to infection.



**CASE 3** September 6, 1921 L M male, age 30 complained of pain beginning in the upper lumbar region, extending downward and forward along the ureter. This pain began insidiously but soon became colic like. There was frequency and hematuria. He had hematuria on no occasion 8 months previously but no other symptoms.

**Urological findings.** Bladder urine negative, except a few red blood cells. Catheterization of the right ureter was difficult, owing to constriction at the ureterovesical outlet. The urine was negative except for a few red blood cells. There was a definite hang of the bulb at the ureterovesical and pelvic junctures. The ureteropyelogram disclosed a hydro-ureter and pelvis, with constriction at the ureterovesical and pelvic junctures. The ureter was dilated to No. 1 F at 10 to 30 day intervals during a period of about 6 months. There has been no recurrence of symptoms. The patient has gained 5 pounds in weight which is in excess of any previous weight. This was undoubtedly a congenital structure which had become involved in an acute edema.

**CASE 4** June 9, 1921 A M male, age 4, complained of frequency and dysuria of several years' duration, with pain in the upper left lumbar region, extending downward along the course of the ureter.

**Urological findings.** The urine was loaded with pus and colon bacilli. The left ureteropyelogram disclosed a mammoth ureter and double renal pelvis with structure at the ureterovesical juncture. This was probably a congenital affair which had become involved in infection.

**CASE 5** April 4, 1921 G D male, age 35, complained of colic like pain of abrupt onset, situated in the lower right abdominal quadrant. There was nausea and vomiting. There was no urinary disturbance, nor any abnormalities in the urine. Appendicitis was suspected, but owing to tenderness at the costovertebral angle the surgeon suspected urinary lesion.

**Urological findings.** There was distinct hang of the bulb at the right iliac crossing. The ureteropyelogram disclosed a definite structure at this point with mild dilatation of the ureter above. The ureter was dilated on three occasions to No. 1 F. There has been no recurrence of symptoms. The patient has gained 8 pounds in weight, which is in excess of any previous weight. A diagnosis was made of congenital structure of the right ureter at the iliac crossing. This is the type of patient who is often operated upon for appendicitis, unless this case is carefully examined from all angles.

**CASE 6** September 2, 1921 F M female, age 34, complained of intermittent attacks of pain situated in the right lower abdominal quadrant and upper lumbar region. This patient had just passed through recent and very stormy pregnancy during which she had frequent exacerbations of temperature and chills associated with great deal of frequency and dysuria.

**Urological findings.** The bladder urine was loaded with pus and colon bacilli. The ureteral pyelogram disclosed an enormously dilated ureter and pelvis

above a constriction at the right iliac crossing. This proved to be a structure of the right ureter at the right iliac crossing with large dilatation above, which had become infected during pregnancy.

**CASE 7** March 9, 1923, N S female, age 16, complained of pain, dull, aching in character, situated in the upper right abdominal quadrant and lumbar region, which began about 4 years previously, and had been almost constant since. There had never been any frequency nor dysuria.

**Urological findings.** The bladder urine was normal. The ureteropyelogram disclosed a slightly dilated right renal pelvis of the drooping type of 14 cubic centimeters capacity. The obstruction was at the ureteropelvic junction, and was probably congenital affair which had recently become symptomatic due to further development of the obstruction.

**CASE 8** June 2, 1921 M J female, age 45, complained of intermittent attacks of colic like pain, situated in the upper right abdominal quadrant and lumbar region, extending downward along the course of the ureter with frequent and painful sensation of several years' standing. A renal fixation had been done but the symptoms continued.

**Urological findings.** The bulb bougie hung at the broad hygment and at the ureteropelvic juncture, the right. The capacity of the renal pelvis was 60 cubic centimeters. (She had just recovered from an attack following which she had passed 1300 cubic centimeters of urine within the first hour.) The urine contained pus and colon bacilli. The ureteropyelogram disclosed structures at the broad hygment and at the ureteropelvic juncture with large dilatation of the renal pelvis. Dilatation of the ureter afforded immediate relief. The outstanding feature of this case is the relief of symptoms following ureteral dilatation, after fixation had failed to influence the symptoms.

**CASE 9** May 4, 1921 S H female, age 27, complained of intermittent colic like pain in the upper right abdominal quadrant, and had been operated upon for appendicitis this accident 6 months previously.

**Urological findings.** The urine was normal. The ureteropyelogram on the right disclosed a kinked ureter in the upper third. The outstanding feature of this case is the probable error in diagnosis of appendicitis.

**CASE 10** September 6, 1921 H S male, age 40, complained of persistent dull pain in the upper left abdominal quadrant which began with colic like exacerbations several years previously.

**Urological findings.** The ureteropyelogram disclosed a kink in the upper third of the left ureter with large dilatation of the renal pelvis above. The urine was loaded with pus and colon bacilli.

**CASE 11** January 5, 1923, N B female, age 30, complained of intermittent attacks of colic like pain situated in the mid left abdominal region, with blood in the urine, but no dysuria. These attacks began about years ago. There had been persistent soreness in this region between the attacks.

*Urological find igs:* The bladder urine was normal, except for a large amount of epithelium. The left ureter was catheterized with difficulty, because of the extreme tightness at the vesical outlet. The ureteropyelogram disclosed a ureter uniformly dilated and kinked in the upper third. The urine was negative except for a large amount of epithelium. The diagnosis was ureteritis involving most of the ureter probably the result of a previous infection. Dilatation and instillation of 1 per cent silver nitrate effected a gradual but slow recovery.

**CASE 1:** August 4, 1921, N. C. female, age 54, complained of colic-like pain in the lower left abdominal quadrant, associated with extreme dysuria and much blood in the urine. There had been no previous attacks of pain, but during the past 10 years this patient had had slight dysuria.

*Urological find igs:* Catheterization of the left ureter was difficult because of tightness at the vesical outlet. The urine contained pus and numerous red blood cells. The ureteropyelogram disclosed a dilated and elongated lower left ureter. Dilatation of the vesical outlet of this ureter with instillations of 1 per cent silver nitrate was followed by prompt relief of this patient's symptoms. There has been no recurrences. A diagnosis was made of ureteritis of probably several years standing with an acute exacerbation probably precipitated by an acute edema involving the obstruction at the vesical outlet.

**CASE 13:** April 24, 1923, C. O. female, age 2, was operated upon for the removal of a pelvic tumor. In the removal of the tumor the ureter was torn. The renal end was tied with catgut which 8 days later softened and urine from this kidney began to drain through the abdominal wound. The surgeon elected to do a nephrectomy. The kidney appeared normal except for moderate inflammation and thickening of the pelvis. A section of the tubules and glomeruli show only very slight changes (Fig. 7).

The reports are necessarily brief; they are presented to illustrate certain types of lesions and only the outstanding features are recorded which I believe are common to these cases. Stone, tuberculosis, etc., were eliminated in each instance. It will be noted that hæmaturia is a prominent symptom. Dysuria is almost a constant symptom with lesions of the lower ureter and in contrast is inconstant with lesions of the upper portion.

## CONCLUSION

It is not my object to inject into the nephropathic situation the problem of ureteral obstruction, without a reason. I desire to call attention to the frequent occurrence and congenital aspect of ureteral lesions and to point out the regularity with which ureteral obstruction in some degree can be demonstrated in these cases of upper urinary tract disease whether a hydronephrosis, a pyelitis, a pyelonephritis, or a pyelonephrosis. In many of these cases with immense dilatation and infection of the ureter and renal pelvis, seen primarily in the "end-result" stage, the early pathology remains in doubt. But if we keep in mind the fact that congenital obstruction is of frequent occurrence that stasis and dilatation invariably follow unrelieved obstruction, that stasis is the prime factor in the development of infection, I believe that we may safely conclude that these factors are operative in the development of these conditions.

Finally it is the early recognition and relief of these obstructions before extensive damage occurs that is the key to the situation rather than treatment in the later stages in which it is evident that the probability of repair is meager.

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VENTRAL TUMORS OF THE SACRUM<sup>1</sup>

By HERMAN W. HUNDLING, M.D. ROCHESTER, MINNESOTA  
*Professor of Surgery The Mayo Foundation*

**T**UMORS of the ventral sacrum comprise a group that develop in the hollow of the sacrum, have a definite capsule, are usually attached to the periosteum, and tend to erode the bone. Middelдорpf first associated them with the postanal gut; they are often spoken of as "Middelдорpf tumors." The tumors may appear to be somewhat rare because of the fact that many persons affected die during birth, or in the first year of life and the condition is not recognized. Births are usually normal; the tumors, as a rule, are about 8 centimeters in diameter; however they may become very large and obstruct delivery. It is believed that females are more often affected than males.

Calbet, who collected a series of cases of sacral tumor in the newborn, found them to occur once in 34,583 births. In a series of 203 cases, 126 were found in the female and 60 in the male. In a series of 107 cases, 30 infants were born dead, 13 were premature, 7 went to full term, and 7 died during birth. These tumors do not, however, occur in children only; a considerable number have been reported in adults. The rarer types, such as dermoids and teratomata, are especially prone to develop in the sacrococcygeal region. In our experience the gliomata have been common. Giant-cell tumors, sarcomata and carcinomata are not rare. Myomata occur occasionally, while fibromata, chondromata, osteomata, lipomata, and chordomata have been seen. Angliomata, epitheliomata, and endotheliomata have also been observed. The other most common types are dermoid cysts (piloid cysts and sinuses), mixed tumors, fetal inclusions, and abnormally persisting or hypertrophic caudal appendages, forming either a pseudo-tail (the result of hypertrophy of the caudal filament), or a true tail (the result of bony overgrowth or prolongation of the sacrum). Herrmann and Tournoux have made a careful study of sacral tumors, and confirm these findings.

The number of developmental errors arising in the evolution of the embryo accounts for the unusual number of tumors found in this region. It is in this area that the caudal termination of the primitive streak should, most accurately, attain its evolution and involution; the neurenteric canal develops and disappears; the anus completes the intestinal tube, the posterior mesoderm properly closes, the coccyx and sacrum develop, and the inferior extremities symmetrically adapt themselves to the trunk. Moreover, within a few millimeters of the area under consideration, the complicated evolution of the genito-urinary tract progresses.

## EMBRYOLOGY

In a study of the tumors of the sacrococcygeal region, it is first necessary to review carefully the embryology of this portion of the spinal cord. Its development varies considerably from the rest of the cord, as demonstrated by Keibel and Mall. At the beginning of the third month the neural tube still extends to the extreme end of the vertebral canal into the tail bud, and there is a close association between its slightly enlarged tip and the deep layers of the skin. Toward the end of the third month the spinal column, developing faster than the soft parts, draws along the part of the neural tube that is adherent to it; the extreme tip of which remains attached to the skin. Because of this unequal growth, the coccygeal portion of the neural tube is bent in the form of a loop of which the deeply situated limb is attached to the posterior surface of the coccyx, while the superficial one assumes a more dorsal position. The deep limb atrophies and disappears during the fourth month; the superficial continues to develop. These structures have been called by Herrmann and Tournoux the "vestigial medullar-coccygens." Later they atrophy, but traces of them may be recognized until the time of birth. Of the cells which line the

<sup>1</sup>These submitted to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science in Surgery, March, 1927.

vestiges coccygens, some flatten to become pavement cells, like the superficial cells of the ectoderm while others lengthen and resemble the prismatic cells of the ependymal covering. Before extensive atrophy has taken place the skin in this region becomes attached to the coccyx by the "caudal ligament" which invaginates and forms a depression, the walls of which are lined with a covering deprived of hair follicles and of sweat glands. The caudal end of the central canal extends through to the beginning of the filum terminale. At the lower end a conical expansion takes place, out of which irregular side pouches or blind elongated sacs develop. This caudal enlargement of the canal is designated as the ventriculus terminalis.

For a time the tail anlage, spinal cord, chorda, and mesoderm develop at the same rate. As the tail bud is reduced there is a reduction in the mesoderm, and the spinal cord temporarily becomes longer than the vertebral column. After the third month the process is reversed, and the vertebral column becomes longer than the cord. This unequal growth brings about a gradual change in the position of the cord in the vertebral canal and results in the caudal end being drawn upward away from the lower end of the canal. During this process of shifting the tip of the cord remains attached to the coccyx and becomes stretched out into the slender filum terminale. The nerve roots and their ganglia, with the exception of the coccygeal ganglion, already attached in the intervertebral foramina, are greatly stretched and are brought into an oblique position, the most caudal root being the largest and most oblique; thus the cauda equina is formed.

During embryonic life while the entoderm is forming the caudal intestine, the dorsal canal and dorsal cord, the mesoderm the connective tissue blood vessels, vertebrae and muscles, and the ectoderm is forming the primitive streak, the medullary tube and its vestiges there is a continuation between the central canal of the spinal cord and the primitive alimentary canal around the caudal extremity of the notochord. This canal which forms the communication between the cord and the gut, is known as the neurenteric canal.

When the proctodaeum or primitive anus invaginates to form part of the cloacal chamber it meets the gut some distance anterior to and above the point where the neurenteric canal opens into it hence there is for a time a segment of intestine behind the anus termed the postanal gut. This, as well as the neurenteric canal, later becomes obliterated.

#### ORIGIN AND TYPES OF TUMORS

Sacrococcygeal tumors are composed of many varieties of tissue and for that reason Rindfleisch has named them histologic pot pourri. Certain authors assert that the majority of these growths are primarily cystic but a smaller number of solid tumors have also been reported.

Various types of structures may be found, as demonstrated by Nakayama, who carefully described thirteen cases of sacral tumors, reported by Chiari. Among the ectodermal structures were found fetal nerve tissue with recognizable ganglion cells, central canal and choroid plexus formations, epidermis and dermoid cysts. An optic vesicle was reported in one case. The structures of the entoderm consisted of rudimentary bronchial segments, often intestines and in two cases each pancreas, liver and suprarenals. In the mesodermal structures there were observed fibrous connective tissue, mucosa cartilage and bone, and often smooth and striated muscle. In one case two maxillae with alveoli and lips and one hand with phalanges, muscles and nails were noted. The variety of tissues in these tumors naturally makes one curious about their origin. In some cases a certain type of tissue may predominate, making a diagnosis more simple. Rests of the fetal neural layers have been considered as a source of these tumors, because of the abundance of neuroglial tissue present. This may form the matrix for a proliferation of the other germinal layers and pave the way for further development.

The remains of the lower end of the neural canal, which closes irregularly may give rise to gland-like structures lined with epithelium, such as Mallory found on examination of the tissues over the coccyx and sacrum six times in a series of seven cases, which he believed

had in consequence of their origin the possibilities of differentiating either into cells like the epidermis (as seen in dermoid cysts and sinuses in this region) or into ependymal cells and their derivatives, such as neuroglial tissue.

Broders has studied a considerable number of these tumors carefully and feels that many of them are ependymal cell gliomata, closely related to carcinoma, since they develop from ependymal cells, which really are slightly modified epithelial cells. These tumors are soft and gelatinous, closely resembling myxomata or colloid carcinomata. On microscopic examination they closely resemble carcinoma of the breast, and some present areas imitating an alveolar arrangement similar to that of the ependymal cells in the cord. Practically all have cells with long tail-like processes resembling the fibrils of fibroblasts.

Many of the cases in which ganglion cells or neuroglia were present were formerly called neuro-epitheliomata, and several interesting cases of this type are reported in the literature. Scheuermann reported the case of a girl 3 months old with a tumor composed of ganglion cells and many neuroglia fibers lying in the sacral region and pressing against the rectum. The tumor was removed and the child made a good recovery. In a group of four cases seen by Engelmann, three of the tumors occurred in the female and one in the male. One patient, a girl of 4 months, had a tumor extending from the coccygeal region to the anus, which was removed; death resulted on the following day. The growth was composed of tentacle-like processes associated with cysts which surrounded the rectum. On microscopic examination glial and connective tissues were found. Another patient, a girl 6 days old, had a large tumor of the anterior sacrum with two attached cysts. In the large cyst glial masses were found. The small one contained long and transverse bundles of collagen-like tissue with simple or cylindrical epithelium, and papillary excrescences.

An interesting case was reported by Pearse. A man, 63 years of age, complained of pain in the lower bowel and over the tip of the spine, with painful defecation. A large cystic

non movable tumor anterior to the sacrum was removed through a posterior incision. The growth was limited by the peritoneum and involved the gluteal muscles. A diagnosis of Middelborg tumor of neural origin was made. Three definite recurrences were noted in this case following several excisions and roentgen ray treatments, the patient was reported well 1 year after the last operation.

The remnants of the notochord are sometimes considered a source of these tumors. They are usually found at postmortem chiefly at the base of the skull and on the coccyx; they have also been demonstrated on the dorsum sellae, the hypophyseal fossa, and more rarely on the sacrum. Some of the tumors diagnosed chordoma, and supposedly arising from the notochord, are very malignant. Daland reported 16 cases of chordoma, 5 of which were in the coccygeal region, and caused pressure on the rectum. Three patients were operated on twice, and all died. One patient died from recurrence following the first operation; one had no recurrence after a successful removal of the growth. As a rule these tumors do not metastasize but tend to invade the rectum. Land's patient, a woman aged 60 years, died following the removal of a smooth, round elastic tumor diagnosed chordoma. The growth was composed of colloid with embedded strands of epithelial cells. She had complained of pain and pressure symptoms over the sacrum and rectum with occasional incontinence of urine and feces.

The presence of nerve tissue interspersed between the epithelial and connective tissue elements has been attributed by Herrmann and Tournoux to a persistence of the medullary coccygeal vestige. They believe that the proliferation of the ependyma and neuroglia are capable of producing cystoid or adenomatous growths, as well as the form called neuro-epithelioma. Borst and Mallory agree that these coccygeal vestiges are largely responsible for dermoid structures in the region of the sacrum and coccyx. Law reported a case diagnosed malignant neuroblastoma which might be considered in this group. The patient, a girl of 16 was pregnant and at full term. After 24 hours of labor the

head was not engaged. Examination revealed a hard fixed tense non-elastic mass in the pelvis, and cesarean section was performed. Because of firm fixation posteriorly it was necessary to perform complete hysterectomy at which time the sacral tumor was recognized. It was removed later through a posterior incision. The girl died a year after ward from local recurrence.

The theories concerning regional anomalies and development from collections of undifferentiated cells, which by the multiplication of their elements form the mammalian tail, must also be considered. Impregnated polar bodies or wandering blastomeres, early thrown out of the complex, single blastomeres with a secondary parasitic embryo over production of granules of segmentation and high differentiation of the posterior portion of the embryo have been mentioned. Other structures must also be considered as possible sources of these tumors, such as the coccygeal gland the end of the dorsal chord the last caudal segment of the embryo and Hensen's nodules.

The Marchand Bonnet theory accords a genetic equality to all composite dermoids, embryos, and parasites. Many authors have chosen the postanal gut as a rather common source of sacral tumors. The growths usually resemble those described by early writers as congenital cystic sarcomata, and are composed of closed vesicles lined with glandular epithelium sometimes cubical and sometimes columnar in type. The cysts are filled with a ropy glue-like mucus, and vary in size from 4 centimeters in diameter to the smallest space visible to the naked eye.

Keen, Bland Sutton, and Middeldorpf are advocates of the postanal gut theory and Middeldorpf was the first to describe these tumors. He reported the case of a girl a year old with a tumor in the region of the anus. With gradual enlargement of the tumor a sinus discharging fecal like material developed. A soft mass which was not attached to the rectum could be felt, and was later removed through a Kraske incision. On examination, the growth was found to be composed of fat and connective tissue with distinct layers of mucosa and the character-

istic mucous glands submucosa circular and longitudinal muscles and many solitary follicles, but no serosa. The tumor probably should be classified as teratoma (the structure resembling a normal organ, the bowel) and might be considered a parasitic fetus. Certain authors have questioned whether this might not have been a persistent postanal gut segment, resembling such abnormalities as Meckel's diverticula, esophageal diverticula, and bronchial fistulae. The fact that cysts are found in the sacrococcygeal region lined with epidermis or cylindrical epithelium is not unusual, when it is realized that the cells of the ectodermal plate are capable of producing epidermis as well as mucous membrane. Other sources for these growths may be found in the cloaca formations and the secondary processes resulting therefrom. Discussion has been warm over the monogerminal and bigerminal theory of the origin of the tumors under consideration. Middeldorpf and others believed that they were due to proliferations of remnants of the medullary canal the neurenteric canal and the hind-gut in association with ectodermal and mesodermal inclusions while others found difficulty in explaining by the monogerminal theory the more complex teratomata when structures such as the eye, bronchus, vertebra, rudiments of intestine, or liver were demonstrated. Such evidence gave rise to the bigerminal theory that tumors, often found at the base of the skull in the sacral region bladder ovary testicle thorax and peritoneum represented an incomplete monstrosity or twin (a parasite engrafted on its autotite or host) while the existent fetus in its early career included the products of a fecundated ovum, a suppressed fetus so-called.

Many authorities according to Law believe that the teratomata, or tumors that show evidences of all three fetal layers, may arise from local disturbances of development of misplaced these anlage known as monogerminal tissue implantations. These tumors according to Herrmann and Tourment, are characterized by the existence of a fetal organ that may be connected with the development of the caudal extremity. It seems that one

tissue alone of these teratomata is able to proliferate and form a growth resembling an epithelioma or a sarcoma. Other observers believe that organs, or rests of organs which normally gradually disappear must be present. There are many advocates for each theory. According to Herrmann and Tourneux, the advocates of the monogerminal theory are Lotzebeck, Braune, von Bergman, Borst and others (reported) by Frank, Ritschelt, Nasse, Linser, Steinthal, Kildrien, and Wietling. The advocates of the bigerminal theory are St. Hilaire, Foerster, Bri-saud and Monod, Darcoste Panum, Calbet, Hagen, Law and Henning.

Many interesting cases of teratomata are reported in the literature. Schramm reported a case of a girl aged 7 weeks, with a congenital rapidly growing tumor between the rectum and sacrum. The growth was composed of fat, nerve and muscle fibers, hyaline cartilage, areas resembling the wall of the stomach, and milk and sweat glands. In a case reported by Baumgartner, a girl aged 13 days, had a sacrococcygeal tumor containing two legs, a pelvis and a loop of intestine. Keen and Coplin reported the case of a child aged 2 years with a congenital sacral tumor with a sinus that drained fecal-like material and communicated with the rectum. The sinus wall histologically resembled a bronchus. Roentgen-ray examination revealed an opening in the lower sacrum, with two lateral projections or attempted duplications, and shadows suggesting the possibility of an incomplete humerus, forearm, and possibly a hand. The child was operated on and recovered.

A great variety of structures may be present in these tumors, as evidenced by the case reported by Frank, of a woman, aged 23 years, who at the ninth month of pregnancy was rapidly delivered of the head and shoulders of her child with the escape of a large amount of brown watery fluid. The delivery was completed without incident. Examination of the child revealed a circumscribed bluish skin-covered tumor with several yellowish white viscid-fluid discharging fistulae in the sacral region. Recovery followed the removal of this tumor which was composed of cysts filled with brownish-

yellow fluid, and areas resembling liver, adrenal and salivary glands, with a thin section of skin along the margins. A diagnosis was made of a true teratoma. In the growth were found structures resembling the choroid plexus and various other parts of the brain, and in pairs, cornea, sclera, ciliary body, retina, and choroidal epithelium. Skin, voluntary muscle, a small kidney, an adrenal with chromaffin, pharyngeal clefts, some intestinal tissue, liver, pancreas, salivary glands, heart and blood vessels were also observed. There was no evidence of the formation of lungs or genitalia.

In Law's case a man aged 27 was operated on and a hard smooth, rounded tumor almost filling the pelvis was removed from the sacrum. The patient died from a local recurrence in 3 months. Because of the fact that one area contained prostatic tissue, the question arose as to whether or not the tumor might be a teratoma of prostatic origin.

C. H. Mayo holds a very liberal view of the origin of these tumors. He believes that teratomata from the coccygeal body are also found in the sacral region; that the mucous membrane comes from the postanal gut, the nerve tissue from the neural tube, and the bone and cartilage from the coccyx and various inclusions of the surrounding tissue. Some of the growths have mucous cysts lined with ciliated epithelium from the neural tube, showing the misplacement of tissue to have occurred before the third month of gestation. According to W. J. Mayo many of these tumors really belong to the teratomata or the group which develop from the vestigial structures. The great shifting about of structures in this region in embryonic life is an important factor. The digestive tract for example at first lies behind the spine, but later adjusts itself so that it lies anteriorly. Because of the intimate relationship between the neural and intestinal tracts, it is not difficult to realize that the carcinomata in this region might arise from the gut, while the ependymal cell tumors might arise from the neural tract.

Very little has been said concerning the origin of the foreign body giant cell tumors that are found in the sacrococcygeal region.



Fig. 1 (Case 1) A photomicrograph showing ependymal cell glioma ( $\times 100$ )



Fig. 2 (Case 3) Ependymal cell glioma with masses of fibrous formation ( $\times 50$ )

It may be well to explain the terminology which is not intended to signify that the tumor is the reaction of the tissue to a foreign body. Mallory says that giant cells of at least two different types occur in tumors. One type results in multiple mitoses and is a true tumor giant cell. It signifies rapid growth and may occur in a variety of malignant tumors. The second type he believes to be due to endothelial leucocytes invading tumors especially those involving bone and fusing to form foreign body giant cells. They are not tumor cells (although the tumors containing them are the ones which receive the name of giant cell sarcoma) and usually signify only erosion and disintegration of bone. Broders asserts that the foreign body giant cell has a definite purpose namely to absorb foreign material and may be compared to an osteoclast. He differentiates the cells by the fact that the true tumor giant cell has large irregular nuclei and often a mitotic figure. The fact that a tumor containing foreign body giant cells destroys bone does not necessarily mean that it is malignant. Several such tumors were found in our series of cases.

Cases also have been noted in which a definite origin of the tumor was not discovered. Pollockson mentions the case of a woman, 25 years of age, who had had several normal deliveries, whose menses stopped and constipation became marked. She had severe pain in the right thigh resembling sciatica. A tumor palpable on rectal and vaginal examination was removed retroperitoneally. It was

believed to be a sarcoma. The right ovary was found to be normal the left was absent.

The simpler dermoids usually arise from areas where during embryonic life coalescence takes place between cutaneous surfaces. These are called sequestration dermoid while the rarer types which seem to arise in obsolete canals are called tubulodermoids. Numerous such cases containing hair sebaceous material and other characteristic contents, in some cases weighing as much as 14 pounds have been reported.

Some of the ventral tumors of the sacrum have proved to be connected with the men-



Fig. 3 (Case 4) Cross section of ependymal cell glioma





Fig. 4 (Case 4) Parodermal cell glioma with cells resembling carcinoma (X100)

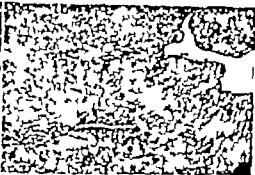


Fig. 5 (Case 5) Parodermal cell glioma (X50) The tumor recurred 6 months after operation

ingres the so called meningocele sacralis anterior." In several instances the tumors have been drained of clear fluid and death followed soon. Bouchot reported that a woman aged 70 years had hydatid cysts on the anterior sacrum, and a large cyst in the liver.

#### PATHOLOGY

Tumors of the ventral sacrum especially dermoids possess much the same character as those on the dorsum, except that they are

usually larger. Often there is nothing to suggest their presence externally. They tend to erode the bone and the neural side always shows greater evidence of pressure than the rectal side. Occasionally these growths may occur as surgical surprises, and may attain large dimensions, extending upward behind the pelvic peritoneum and causing intra pelvic pressure symptoms. As a rule they never extend upward above the posterior superior margin of the gluteal muscles. The larger ones seem to develop forward toward the pelvis and downward between the legs, displacing the genitals and anus downward and forward. In the growth forward they press the uterus up without spreading the broad ligaments. It is possible that the tumors may extend deeply between the vertebrae and cause paraplegia by pressure on the cord. As a rule they are smooth and sharply defined.

Early writers believed that malignancy was the rule, some cases were definitely malignant, as evidenced by the fact that local recurrences were sometimes found following removal of the tumor. Metastasis was relatively uncommon. Because of the fact that these tumors often contain granular and testicular tissue, there is a tendency for some of them to undergo malignant change (Murphy). The few reported cases of chorio-epithelioma in teratoids, warrant the assumption that malignant transformation is possible. Broders does not believe that metastasis occurs, but that death is caused by infiltration. The prognosis is bad because of the location, since



Fig. 6 (Case 7) Cross section of dermoid cyst



Fig 7

Fig 8

Fig 9

Fig 7 (Case ) Foreign body giant cell tumor ( $\times 100$ )

Fig 8 (Case ) Foreign body giant cell tumor ( $\times 50$ )

Fig 9 (Case 2) Foreign body giant cell tumor ( $\times 100$ )

#### DIAGNOSIS

In cases in which spina bifida is associated it is sometimes difficult to decide clinically between a spina bifida sac, meningocele, myelocele, myelomeningocele, hydrorachis, and dermoid. Differentiation must also be made of fibroids, ovarian cysts, intraligamentous cysts, ischio-rectal abscesses, congenital dorso-sacral herniae containing bowel and bladder, lymphangiomata, angiosarcomata or peritheliomata, and simple lipomata. The roentgen-ray is of diagnostic aid especially in clearing up the diagnosis of spina bifida.

#### TREATMENT

Most authors advise removal of the growth when possible. Murphy advised careful complete dissection and removal because he believed the structures to be embryonic in origin and potentially malignant. According to Scheuermann the operation is more successful after the first year of life. Of 42 patients operated on after the first year 33 lived, of 17 patients under one year 9 lived. For a time these cases were considered unfavorable for operation because of the difficulty of approach by the anterior incision and the danger of hemorrhage. Since the Kraske procedure has been instituted of opening the

#### SYMPTOMS

Constipation is often the only symptom. Pain in the sacral region, and down the thighs, suggesting the picture of sciatica, is fairly common. The pressure in the pelvis may be the first indication of pathological change. Often there are no symptoms, and the tumor may first be suspected in connection with difficult labor. The first indication of a growth may be suppuration with sudden drainage into the rectum, bladder or vagina, or even into the perineum.



Fig. (Case 3) Cross section of myosarcoma

pelvis posteriorly by resection of the coccyx and lower sacrum much more satisfactory results have been obtained. The approach is easy and provides freedom from disturbance of the other organs. According to W. J.

Mayo early surgical intervention is the proper form of treatment. He recommends the posterior approach with rapid removal of the growth, which should be thoroughly scraped away. Hot packs are usually required to



Fig. (Case 3) Myosarcoma (X100)



Fig. (Case 14) Sarcoma with foreign body and xanthomatous cells (X100)



Fig. 3 (Case 5) Adenocarcinoma (X100)



Fig. 4 (Case 6) Gross section of colloid carcinoma

check the bleeding and the wound is then packed with gauze. Extensive radium radiation is applied after the operation.

Favorable results have been reported by Coley with the use of the mixed toxins of *Corynebacterium erythrasma* and *bacillus prodigiosus*. In successful cases the effect is usually promptly noticeable as evidenced by the fact that the tumor becomes smaller, is more easily movable and less vascular. In a case reported by Massey, a young woman aged 26 with fibrosarcoma of the ventral surface of the sacrum was treated with massive disseminations of mercuric ions with a strong electric current, and the tumor disappeared.

#### CASES REPORTED FROM THE MAYO CLINIC

Nineteen definitely proved cases of tumors ventral to the sacrum were observed. Eight additional cases were diagnosed clinically but were not included in the series either because they did not come to operation, or because the diagnosis was not satisfactory from specimens removed.

**CASE 1 (A34459)** Mr. E. A. T., age 47, registered at the Clinic December 27, 1920. For the last 7 years he had suffered from pain in the rectum, coming on in spells, usually worse at night, and lately requiring morphine for relief. Constipation

had been distressing for 3 months. Fifteen months before examination he became unable to void, and had since catheterized himself every day. For the last 4 months he had had crampy pains down the legs and slight numbness around the rectum and genitalia. There was no loss of weight. Pus and blood cells were occasionally found in the urine. On rectal examination a hard, non-tender, smooth, globular mass was felt posteriorly, apparently attached to the sacrum. A roentgenogram of the sacral region was negative. January 3, 1921, laparotomy was performed and the mass in the sacral region explored. No evidence of metastasis was found, and the wound was closed. January 31, 1921, a large ghoma which had eroded the coccyx and part of the sacrum was removed through the Kraskie incision. The greater part of the tumor was composed of a jelly-like substance, which was removed with difficulty. Microscopic examination revealed epidermal cell ghoma (Fig. 1). The patient's convalescence was uneventful. Roentgen ray and radium treatments were administered. In August, 1922 (9 months after operation) the patient had gained 16 pounds and was still taking roentgen ray treatments. The function of the bowels and bladder was disturbed. The patient's health was rather poor and there was still slight drainage from the wound.

**CASE 2. (A158405)** Mr. S. K. W., age 68, registered at the Clinic April 27, 1916. He had had difficulty in urinating and nocturia for 3 weeks. For 1 month he had been constipated and bothered with hemorrhoids. There was slight pain in the left sciatic region. A trace of albumin was found in the urine. Rectal examination revealed moderate



Fig 15 (Case 7) Myoma

enlargement of the prostate, but the gland was uniform in size and consistency. There were few small hemorrhoidal tags. The patient was seen again in 8 months. The pain had become quite severe at night mainly in the region of the left sciatic nerve. A diagnosis of tumor of the sacrum was then made. Roentgenograms revealed destruction of the middle portion of the sacrum. At operation, November 28, 1916, an inoperable growth of the sacrum, extending into the rectum, was found. The sacrum consisted of shell of bone filled with old clots. A large piece of gelatinous tissue, on macroscopic examination, proved to be part of an ependymal cell glioma. The patient's convalescence was uneventful. The tumor increased rapidly in

size the next months. In January 9, 1917, 4 months after operation, the patient died of intestinal obstruction.

CASE 3. (Age 95) Mr D C age 33 registered at the Clinic July 2, 1909. Operation for hemorrhoids and curettement of an ulcer of the rectum had been performed elsewhere, at which time tumor (of the rectum) was found. The patient came for examination of this growth. He had been constipated for the past 35 years. Pain, severe enough at times to require morphine, had been present in the sacral region. A peculiar nervous sensation from the knees to the toes had been present for the last few days. Eight pounds in weight had been lost. On rectal examination large rounded mass was felt



Fig 16 (Case 7) Myoma (X 400)



Fig 17 (Case 8) Cellular myoma (X 100)



Fig. 7 (Case 8) Cross section of myoma

to the left, and filling the hollow of the sacrum July 4, 1900, a tumor pressing on the rectum and apparently having its origin from the perosteum of the sacrum, was removed through a Kraske incision. The wound was packed with gauze. Microscopic examination revealed an ependymal cell glioma (Fig. 3). The patient's convalescence was uneventful. Extensive radium radiation was carried out, and Coley's serum administered. The patient gained 5 pounds in the first year after operation. In March, 1907 he was unable to void, and catheterization was necessary. Obstipation was marked. Later movable, non-tender mass became palpable in the suprapubic region, and an extensive mass was felt by rectal palpation. The patient died May 8, 1909, 8 1/4 years after the operation.

CASE 4 (A13553) Mr. W. E. age 44 came to the Clinic March 7, 1903 complaining of a recurrent tumor of the back. He had fallen, striking on the lower spine, 5 years before. Six years before a fatty tumor had been removed from the lower part of his back. A growth recurred in 1 year and was burned out 7 years later. The present growth in the sacral region 3 centimeters in diameter had developed 3 years before. On rectal examination tumor 3 centimeters in diameter could be felt pushing the rectum forward. March 30, 1903, an irregular tumor measuring 3 centimeters attached to the perosteum of the sacrum and extending to the bowel, was removed (Fig. 3). A diagnosis of ependymal cell glioma was made on microscopic examination (Fig. 4). The patient's convalescence was uneventful. In August, 1909 years later the patient was perfectly well.

CASE 5 (A130305) Mr. A. S. age 38 registered at the Clinic June 6, 1900. Three years before, he had injured his rectum with a spike. He complained of pain after sitting and of increasing constipation during the last 3 months. A diagnosis of a "growth of the rectum" had been made elsewhere and a colostomy advised. Ten pounds in weight had been lost. On rectal examination a large, round, fairly firm non-fluctuating mass was palpated between the rectum and the sacrum. June 3, 1900, a large soft tumor apparently honey-combing the anterior surface of the sacrum, was removed through a Kraske incision. There was much oozing, and the wound was packed with gauze. Microscopic examination revealed an ependymal cell glioma (Fig. 5). The patient's convalescence was uneventful. Roentgen ray and radium treatments and Coley's serum were given. In April, 1902, an operation, its nature not known, was performed elsewhere. In August, 1902, 2 years after the first operation the patient had lost 10 pounds. The tumor recurred 6 months after operation, but gave rise to no discomfort.

CASE 6 (A137506) Mrs. J. F. D. age 67 registered at the Clinic August 3, 1905. She complained of a small tumor at the end of the spine, which had been present for 50 years and was causing moderate discomfort. The tumor had grown slightly during the last 3 years. Discomfort in the coccygeal region had been growing increasingly worse the last 8 months. There was considerable aching in the left hip and thigh. Roentgenograms of the lower spine revealed apparent destruction of the fifth lumbar vertebra, probably due to old Pott's disease. Rectal examination revealed a

regular,lastic, movable mass posteriorly. September 3, 1915, a tumor measuring 8 by 8 centimeters, and made up of two separate compartments (ultimately associated with the rectum) was removed from the hollow of the sacrum. The pathologist reported the tumor to be a postanal dermoid containing cholesterol. The patient's coelascence was uneventful. A roentgen ray, radium, or serum treatments were given. In August 9, 7 years after operation the patient reported that 3 years previously the tumor had recurred. It had increased somewhat in size and was painful at times. The function of the bladder and bowels was slightly disturbed.

CASE 7 (A117710) M. H., a girl, age 3, as brought to the Clinic October 10, 1914, on account of a small lump over the lower spine. The mass, as first noticed when the child was 3 weeks old, recently it had increased in size. A non-tender, cystic mass measuring about 4 by 7 centimeters, in a hard area in the center was found in the lower coccygeal region. October 26, 1914, a postanal dermoid with two compartments, one extending into the pelvis and the other into the buttocks, was removed (Fig. 6). The child's coelascence was uneventful. No answer has been received to letter of inquiry concerning the patient.

CASE 8 (A117711) Miss B. K., age 9, registered at the Clinic July 9, 1914. The patient was born with a small lump on the lower spine (this grew slightly and was drained when she was 14 years of age, a large amount of pus was removed. It was drained again 1 year later. She came to the Clinic because of draining sinuses in the coccygeal region. On examination several old, discharging sinuses were found posterior to the anus. Rectal examination revealed a small mass posteriorly not connected with the coccyx. July 9, 1914, a large multilocular infected cyst, lying against the crum, removed through the old scar. The tumor was closely adherent to the rectum and extended laterally. The sinus measured 6 by 1 centimeters, and had many fistulous openings. On examination it proved to be a dermoid cyst. The patient's convalescence was uneventful. In August 9, 8 years after operation, the patient was entirely well and had gained twenty-five pounds.

CASE 9 (A179446) Mrs. E. V., age 3, registered at the Clinic December 7, 1910. Appendectomy, myomectomy, and bilateral salpingo-oophorectomy had been performed elsewhere 3 years before. The patient complained of nervous headaches and pain in the lumbar spine, especially on stooping. Examination of the rectum revealed a small mass to the right and posteriorly. Roentgenograms of the sacrum revealed nothing abnormal. December 8, 1910, the allied cyst measuring 8 by 8 centimeters situated to the right and behind the rectum and apparently not communicating with the bowel, was removed through posterior incision. A portion of the levator ani muscle was sacrificed. The cyst proved to be a dermoid lined with squamous epithelium and containing a thick brownish substance. The convalescence was uneventful. In August, 9, 8 months after operation, the patient had gained 15 pounds in weight and was perfectly well.

CASE 10 (A378303) Mrs. C. S., age 36, came to the Clinic November 8, 1911. She had complained of pain in the legs, weakness, and pain in the lower back on bending for the last 14 months. Her legs acted slowly and tired easily. There was no loss of weight. Examination revealed a large tumor in the pelvis, projecting forward from the sacrum. Roentgenograms of the lower spine were suggestive of tumor of the pelvis, with possible involvement of the sacrum. December 9, 1911, a growth measuring 6 by 10 centimeters, very soft, bloody and friable, was removed through a Kraske incision. The wound was packed with gauze and the patient transferred.

On histological examination, diagnosis of foreign body giant cell tumor was made (Fig. 7). During the convalescence the patient developed an abscess of the breast, which was drained three times, an anal fistula which was operated on three times, and an abscess of the buttock, which was also drained. Lateral radium radiation was used. In August 9, 9 months after the operation, the patient was apparently well, and as working. She returned to the Clinic for examination at that time and no evidence of recurrence was found. There was still slight drainage from the wound.

CASE 11 (A66665) Mrs. H. L., age 57, registered at the Clinic June 4, 1913. One month before her anal sphincter had been dilated for fissure. She had had almost complete obstruction of the bowels for 5 months following sudden profuse hemorrhage from the rectum. There was tenderness in the pubic region, and pain radiated from the sacral region to the thigh and vagina. There was slight urinary incontinence. On examination, a tumor was found posterior to the rectum. June 10, 1913, a mass measuring 8 by 10 centimeters which had perforated posteriorly and involved the third, fourth and fifth sacral vertebrae was removed through a Kraske incision. Some of the tissue was soft and was scraped out of the hollow of the sacrum. The wound was packed with gauze. Microscopic examination revealed foreign body giant cell tumor (Fig. 8). The patient's convalescence was uneventful. Later roentgen ray treatments and numerous injections of Coley serum were given. In August 9, 9 years after operation, the patient had gained 10 pounds and had no noted recurrence. She was markedly constipated and it was necessary to use enemata. Because of pain and swelling in the right knee crutches were used.

CASE 12 (A 84667) Mrs. F. R., age 7, came to the Clinic August 9, 1910. For 6 months she had had stiffness in the back of the legs with soreness over the lower spine. Later tingling and prickling sensations appeared in the legs, and standing was difficult. Occasional pains were present in the left lower abdomen. Twenty pounds in weight had been

lost. On rectal and vaginal examinations, a large firm, rather tender nodular mass was found lying against the sacrum August 5 1919, an encapsulated growth measuring 10 by 12 centimeters was found behind the rectum and extended down to the level of the internal os. While the growth was being removed, considerable bleeding occurred, because of extensive erosion of the anterior surface of the sacrum. The patient was in poor condition, and died shortly after the operation. Microscopic examination of the growth revealed a benign foreign body giant cell tumor (Fig. 9).

CASE 13 (A133337) M J W B age 64 registered at the Clinic March 30 1911. He complained of having had sharp shooting pains in the rectum, and pain in the lower abdomen for the last year. There had been gradually increasing constipation, and frequency of urination for 14 years. A month before, there had been almost complete retention. Eighteen pounds in weight had been lost. Examination of the abdomen revealed a mass in the lower quadrant, near the middle line. A large, hard, smooth, immovable mass was found to the right of the prostate, extending up behind the bowel and filling the hollow of the sacrum April 11 1911 a tumor measuring 10 by 14 centimeters was cleanly removed through a posterior incision, with the exception of a small portion of the capsule which was adherent to the anterior surface of the sacrum (Fig. 10). A diagnosis of myosarcoma was made on microscopic examination (Fig. 11). Radium needles were inserted at the site of the growth and the wound packed with gauze. There was slight post-operative hemorrhage and a transfusion of 500 cubic centimeters of citrated blood was given. The patient improved and gained weight. He returned home, and in spite of extensive roentgen-ray and radium treatments gradually became weaker. Later a mass was reported palpable in the pelvis, behind the bladder. The patient died March 4, 1912 months after operation.

CASE 14 (A 914) Miss E B age 9 came to the Clinic April 24, 1917. She had always had a great deal of pain with menstrual periods. In October 1916 a shortening of the tensor ligaments and appendectomy were performed without relief of the pain. She also complained of pain in the lower back, of 5 months duration this was especially noticeable on walking. Lately she had had rather severe pain in the left hip extending down the legs. She had lost 3 pounds in weight. On vaginal examination a large, firm, compressible mass, painful on pressure was found in the center of the pelvis. Considerable tenderness was present over both sciatic nerves. Roentgenograms of the lower spine revealed an unusual prolongation of the first sacral transverse process. April 30, 1917 a soft, semi-fluctuating, encapsulated, freely bleeding mass was removed from the anterior surface of the sacrum through the old abdominal incision, and a glass tube inserted for radium treatments. The patient bled a great deal and was given 800 cubic centimeters of

normal saline intravenously. On microscopic examination of the tumor a diagnosis of sarcoma with foreign body giant cells and mitoses was made (Fig. 9). The patient's convalescence was uneventful, under roentgen ray and radium treatments she progressed nicely until June 1917 3 months after the operation, when she became unable to walk and complained of pain in the legs and back. She gradually became weaker and died June 8 1918 14 months after the operation.

CASE 5 (A174820) Mrs G M age 40, registered at the Clinic October 9, 1916. She had had a difficult labor with the birth of her first child, 5 years before, her second labor 3 years before had been normal. Eighteen months before she had fallen on her coccyx, and had pain in the coccyx and down the left thigh. This pain was worse during pregnancy. Labor had been induced the eighth month, after a rectal examination which revealed a tumor 5 by 7.5 centimeters anterior to the sacrum. The tumor which had appeared cystic, was reduced about one half in size and became firm after the labor. Slight urinary incontinence had been noticed since the delivery and the bowels moved with difficulty. October 16 1916, a laparotomy was performed and both internal iliac arteries were ligated. A small fibroid was removed from the back of the uterus, and the fundus sutured to the posterior pelvic peritoneum. October 27 1916 11 days later a vascular flattened tumor measuring 9 by 1 centimeters, eroding the sacral perosteum was removed through posterior incision and the wound packed with gauze. Microscopic examination of the tumor revealed adenocarcinoma (Fig. 13). The patient's convalescence was uneventful, except for the development of several small ischio-rectal abscesses. Radium treatment was instituted. In September 1918 2 years later the patient reported that 6 months before she had developed scoliosis and kyphosis in the lower dorsal region, with severe pains in the back. A plaster cast afforded slight relief. Later signs of paralysis developed, but there was no obvious recurrence.

CASE 16 (A174670) Mrs L C L age 49, registered at the Clinic June 11 1919. She had had seven operations in the last 20 years for rectal abscesses, fistulae and hemorrhoids. She complained of fistulae which were still present posterior to the rectum and also of loss of weight and strength. On examination a small opening was found at the tip of the sacrum draining pus. At operation June 14 1919, a specimen was removed for diagnosis, and a week later a tumor measuring 14 by 16 centimeters with two discharging sinuses was removed from the hollow of the sacrum (Fig. 4). On microscopic examination of the tumor a diagnosis of colloid carcinoma was made. The patient's convalescence was uneventful. Numerous roentgen ray and radium treatments were given. In August 1921 3 years after operation, the patient had gained 50 pounds in weight, and had no evidence of recurrence.



**CASE 17 (A374449)** Mr W M J, age 37, came to the Clinic June 21, 1919. His back had been injured in a mine 3 years before and for the last 5 years he had complained of almost constant rather severe pain in the lower back, radiating down the back of the left thigh and leg. He had lost 5 pounds in weight. An exploration had been performed in April, 9, for sarcoma of the prostate. Rectal examination revealed a mass about 5 centimeters in diameter apparently beneath the mucous, just above the prostate, possibly involving this structure, and attached to the right sacral all June 30, 1919, perineal incision was made, and hard, rounded, fixed tumor was felt which could not be removed at this time without great risk. The patient developed acute urinary retention, and the bladder was drained suprapubically the following day. July 18, 1919, a solid tumor measuring 9 by 1 centimeters, lying in front of and eroding the sacrum, was cocleated (Fig 15). The tumor completely obstructed the urethra, so that it was necessary to make a permanent suprapubic cystostomy. The sacral wound was packed with gauze. A histological diagnosis of myoma was made (Fig 16). For 1 year the patient had roentgen-ray and radium treatments and was in good health. He returned to the Clinic in November, 1921, 3½ years after operation complaining of a return of the pain in the back and legs, with some urinary incontinence and urgency. Examination revealed a large mass in the pelvis, apparently attached to the sacrum. An enlarged inguinal gland thought to be metastatic was excised and found to be fibrous tissue. November 28, 9, 3½ years after operation, the patient was again operated on; a large fibrous, fixed mass was found in the hollow of the sacrum which could not be removed. Radium needles were inserted. January, 1922, 3 years after operation, the patient had gained weight and was feeling well.

**CASE 18. (A37078)** M E B, age 56, registered at the Clinic July 30, 1920. An exploration had been performed in June, 1920, for tumor in the pelvis. The patient had had an ache at the end of the spine for 4 months, becoming almost constant of late and worse when he was sitting. Rectal examination revealed a smooth, encapsulated mass posteriorly and to the right. Roentgenogram of the colon revealed filling defect in the region of the sigmoid. August 10, 1920, a hard tumor measuring 1 by 12 centimeters was removed from behind the rectum through a posterior incision (Fig 17). The tumor shelled out readily and left a large bleeding space. A diagnosis of cellular myoma was made on microscopic examination (Fig 18). The patient recovered readily from the operation, but died apparently from a recurrence, in July 1921, year after the operation.

**CASE 9. (A3178)** Mr W M T, age 34, came to the Clinic October 24, 1917. He gave history of an injury to the sacrum 5 years before, when he fell against a box. For the last 3½ years he had had a dull pain in the sacrum, worse after exer-

tion, and gradually becoming more intense lately the pain extended into the legs and was severe enough to keep him awake. He had been operated on a few weeks before and granulations were found in the cavity of the sacrum. The section for histological study which the patient brought with him revealed basal cell epithelioma. There had been some relief after the operation, but the pain was still present in the buttocks and hips. The patient had lost 8 pounds in weight. On examination by rectum no tumor was palpated but there was tenderness on pressure over the sacrum. A sinus which drained pus, and apparently had necrotic base, was found over the sacrum. November 19, 17, a posterior incision was made and the sacrum found to be largely destroyed exposing the sacral plexus. The wound bled freely and was packed with gauze. The tumor removed proved to be inflammatory. The patient's convalescence was uneventful. Roentgen-ray and radium treatments were administered. The patient could not be traced in 9.

#### SUMMARY

Ventral tumors of the sacrum (so-called Middelkorp tumors) are definitely encapsulated, are usually attached to the peritoneum, and tend to erode the bone. The greatest pressure is exerted on the neural and not on the rectal side.

Remains of the lower neural canal and the postanal gut appear to form the basis for many of the ventral tumors.

There is great diversity of tissue in these growths all the body tissues may be represented.

Opinion seems about equally divided with regard to the monogerminal and bigerminal theories of origin of these tumors.

Ventral tumors of the sacrum seldom metastasize but cause death by infiltration.

The blood picture is practically always normal, and the urine rarely shows unusual changes. Systemic reaction of the tumors is mild.

Pain, resembling sciatica, and constipation are often the only symptoms.

The roentgen-ray findings are practically always negative.

Treatment consists of the removal or scraping out of the tumor followed by extensive radium radiation.

Five patients with ependymal cell glioma were operated on at the Mayo Clinic. The average age of the patients was 46 years. One

patient was perfectly well 10 years after operation, and 1 showed improvement 19 months after operation, but complained of disturbance of function of the bladder and bowels. One died of recurrence 9 years after removal of the growth. An exploration was made in 1 case which proved inoperable and the patient died 14 months later of intestinal obstruction. One had a recurrence 2 years after operation, but without discomfort.

Dermoids were removed in four instances. The average age of the patients was 30 years. Postoperative data were obtainable in three of these. Two patients were well one 1 year after operation, and one, 8 years after operation. One patient had a recurrence 5 years after the removal of the tumor.

There were three patients with foreign body giant cell tumors. The average age of the patients was 40 years. One patient was apparently well 15 months after removal of the growth. Almost complete recovery was reported by another 10 years after operation. A third patient died following operation.

Cardinomata were found in two instances. One patient, age 40 had an adenocarcinoma, and was practically well 2 years after operation. One age 49 had a colloid carcinoma and was markedly improved after its removal.

Myomata were removed in 2 cases. One patient, age 37 was improved 3 years after operation, and one age 56 died from recurrence 1 year after operation.

One patient, age 64 with a myosarcoma, died from recurrence 1 year after operation.

One patient, age 19, died from recurrence 15 months after the removal of a sarcoma. The growth was composed of foreign body giant cells with mitoses. One patient had an inoperable basal cell epithelioma.

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# THE USE OF BOILED BEEF-BONE INTRAMEDULLARY PEGS IN THE FRACTURES OF LONG BONES

## AN EXPERIMENTAL STUDY<sup>1</sup>

By CHARLES DAVISON, A.M., M.D., F.A.C.S., CHICAGO

Head of Department of Surgery, University of Illinois College of Medicine, Surgeon, University Hospital, and

FREDERICK CHRISTOPHER, B.S., M.D., F.A.C.S., CHICAGO

Assistant in Experimental Surgery, University of Illinois College of Medicine, Assistant Surgeon, St. Luke's Hospital, Junior Surgeon, Frothingham Hospital

IN the hope that further light might be shed upon the desirability or the undesirability of the use of boiled beef bone as an internal splint in fractures, a study of the fate of the intramedullary boiled beef bone peg in recent fractures in dogs was made in the experiments which follow.

A standard operation was determined upon. In the earlier cases the dogs were shaved the day before the operation and a wet very dilute bichloride dressing was applied. Later this was abandoned as it was felt that the prevention of infections was dependent entirely upon the care with which the preparation was done at the time of the operation and the technique of the operation itself.

The operations, with the exception of the first few, were done under the most favorable circumstances. A hospital operating room was placed at our disposal with full complement of internes and nurses, and the same technique, or if anything a more painstaking one as employed in human beings was used.

After completely anesthetizing the animal with ether the upper arm and shoulder were widely shaved and dried with alcohol and ether and painted with full strength tincture of iodine. The animal was then draped. A longitudinal incision was made over the upper arm and the muscles retracted, care being taken not to injure the musculospiral nerve.

After the humerus had been exposed for a distance of 3 to 5 centimeters, a Gigli saw was passed under it, and the bone was sawed through at right angles to its axis. The two sawed ends of the humerus were brought up into the wound and the marrow cavity was

lightly curetted out. A beef-bone peg, which had been boiled for at least 3 hours, was selected of such size as to fit tightly into the marrow cavity. It was thought best in the latter two-thirds of the experiments to use rectangular pegs in the round medullary cavity. By this arrangement there were four points of contact of the peg with the internal circumference of the bone and the intervening areas of the endosteum were not subjected to any pressure (Fig. B).

The length of each peg was at least twice the width of the bone into which it was inserted. After both fragments were slipped over the peg and approximated, the fractured bone was held together stiffly and rigidly. The muscles and subcutaneous tissue were approximated and the skin closure was carefully done.

Collodion was painted over the wound, and after a dressing was applied a snug plaster cast was put on so as to include the neck, shoulder, back, and the entire arm except the paw. These casts were generally removed at the eighth week, and the animals were killed by ether at the desired dates.

The following are typical case histories in dogs which did not die of early infection.

Dog 6. Operation November 26, 1920. Large dog. Preparation 5h. ve. and iodine. 1 the time of operation. Typical operation. December 4, 1920, abrasion under the left arm has become infected and the constricting area of plaster cut away. Dog otherwise healthy. January 3, 1921, the superficial abrasions caused by the cast have become numerous and badly infected so that the hair is soaked with swelling pus and the cast has become softened. The cast is therefore removed on this day (the thirty-eighth postoperative). Palpation of the arm at the site of the fracture showed crepitus and abnormal mobility. As it seemed to be unwise to put on an



Fig. (above) Dog 5. Roentgenogram 4 days after operation. Boiled beef bone peg in place in medullary cavity.

Fig. Dog 8. Roentgenogram 5 days after operation. Shows boiled beef bone in place.

other cast or to let the dog be without operation. The humerus was disarticulated and removed in one piece for histological examination. At the site of the fracture there was marked proliferation of dense connective tissue which formed a fibrous capsule over the two ends of the live bone. As there was considerable motion at the site of the fracture this connective tissue acted as the capsule of false joint. About one centimeter from the fracture on the distal fragment was a tough projection on the bone measuring 3 centimeter by 3 centimeter by 1 centimeter and which was composed of connective tissue with probably some early bone formation. On cutting open the fibrous capsule at the fracture the boiled beef bone peg was found to be firmly embedded in the distal fragment (doubtless the one into which it had been driven at the time of the operation). The proximal end of the peg moved about freely in the marrow cavity of the proximal fragment which marrow cavity had been eroded so that its internal diameter was greater than it was at the time of the operation. The distal fragment and the attached bone peg were sawed through longitudinally and the peg was seen to extend well into the cancellous part of the bone. It was in intimate contact with the marrow along its entire extent. At roscopically there had been no absorption of the peg.

Dog 8. Operation December 1920. Small black and tan dog. Preparation. On the day pre-



Fig. 3 (upper) Dog. Roentgenogram 3 days after operation. Shows fracture splinted by three boiled beef bone intramedullary pegs.

Fig. 4 (middle) Dog 3. Roentgenogram 584 days after operation. Shaft angulated to nearly 90 degrees. Fragments of the pegs may be seen in each end of the fragments.

Fig. 5 (lower) Dog. Roentgenogram 377 days after operation. Firm union at the site of the fracture.

ceding the operation this dog was shaved and a wet bichloride dressing was applied. Typical operation. Dog was killed on January 3, 1921. February 7, 1921 dog died following week's illness which was characterized by coughing and vomiting—fifty-ninth day postoperative. On removing the cast, the humerus was found to be bent to an angle of about 45 degrees and apparently was firmly united. Dissection, how-



Fig. 6. Dog. Appearance of cross section at death, 4-5 days after operation. Note remnants of boiled beef bone pegs which almost have been absorbed.

ever showed that there was a large amount of callus formation and fibrous union and that there was actually a slight amount of motion at the site of the fracture. The specimen was sliced through longitudinally and it was found that the bone peg had slipped out of its engagement in the upper fragment and in resting against the cortical margin of that fragment had formed a false joint there. There was no evidence of union between the peg and the upper fragment. The peg was firmly embedded into the lower fragment (Figure A) and macroscopically there was clear line of demarcation between the peg and adjacent marrow.

Dog. Operation, December 30, 1920. Small black and tan dog. Preparation. Shaved the same

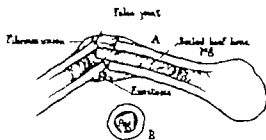


Fig. 7. Dog. Photograph taken just before death, 4-5 days after operation. Shows angular union of right humerus.

morning as the operation and skin painted with iodine at the time of the operation. In this case the humerus was fractured by means of a bone cutter instead of by the Gigli saw. As a consequence about 3 centimeters of the side of the distal fragment was broken off, the part broken out being from the bone adjacent to the main fracture. The peg was inserted with great difficulty and when in place was not very secure. After the operation the dog was unable to extend the paw of the affected arm and the dorsum of this paw had become worn, sore, and free from hair. This was taken to be evidence that the musculospiral nerve had been injured. March 19, cast cut away from an infected wound of the fore arm. March 21, 1921, dog well. March 22, cast removed. A severe infection of the chest wall had occurred under the cast. There was no union at the site of the fracture. March 23, dog died presumably from the infection of the chest wall. The bone fragments were found to have become disengaged. There was a firm fibrous union. The bone peg was firmly united to one fragment. There was muscular and fibrous attachment to the bone peg.

Dog. Operation, January 7, 1921. Large St. Bernard puppy weighing about 60 pounds. Preparation. Shaved about 5 days previously and wet bichloride dressing applied. The operation was the usual one so that the marrow cavity was so large that it required three large bone pegs to fill it. On February 4, 1921, it was noticed that the dog had eaten through the cast so that it offered no support to the fracture. The cast was accordingly removed. It was found that there was an angulation at the site of the fracture of about 45 degrees and that on palpation a very faint crepitus or grating could be made out. The dog is in excellent general



Fig 8

Fig 8 Dog 14 Roentgenogram 7 days after operation. Shows healed beef bone completely disengaged from one fragment and the bone ends separated. Peg evidently too short.



Fig 9

Fig 9 Dog 4 Roentgenogram 66 days after operation. Showing fragments overlapping with cross union.

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Fig 10

Fig 10 Dog 14 Roentgenogram 354 days after operation. Firm union.

health March 8, 1921: there may still be felt a slight crepitus; dog well. March 22: large amount of callus, dog well, union nearly firm. May 13: there is apparently a false joint at the site of the fracture. Dog well. June 10: definite false joint. Dog well. October 18: firm union, dog well. February 8, 1922: dog has good use of leg but limps slightly. February 12, 1922: killed. Macroscopically there is marked absorption of the remnants of the pegs (Fig 6).

Dog 14: Operation, January 8, 1921. Small black and tan dog. Shaved 3 days previously and leg wrapped in wet bichloride dressing at that time. The dog was a mild one and the marrow cavity was very small. There was good deal of difficulty in fitting a peg into this marrow cavity. February 4, 1921: X-ray examination showed the peg to be completely disengaged from one fragment and the bone ends to be rather widely separated. March 8: dog well. March 22: dog in labor and therefore cast removed. Fibrous union only. Wound clean. Five puppies born. April 8: dog well. June 10, 1921: dog uses leg and is well. February 8, 1922: dog uses leg well. February 24, 1922: killed.

Dog 15: Operation, February 4, 1921. Medium sized black and tan. Preparation 3 days before the operation, but the dog had torn off the protective dressing. Typical operation. March: severe infection underneath the cast. April 8, 1921: cast removed. Infected wound near the head of the shoulder from which several bone sequestra are be-

ing extruded. Union doubtful. May 13, 1921: wound practically healed. Dog well. June 10, 1921: dog well, but doesn't use leg. January 12, 1922: killed in dog fight. Pus cavity between the ends of the bone. No union. Persistence of sequestrum formation.

Dog 19: Operation, March 18, 1921. Typical operation. March 1: X-ray shows that the bone fragments have become disengaged. April 8, 1921: dog well. December 13, 1921: killed in dog fight.

Dog 2: Operation, April 5, 1921. Typical operation. Dog prepared at the time of the operation. June 24: cast removed. Dog well. February 8, 1922: dog limps. February 12: killed. The specimen showed a false joint with fibrous union. The peg was not definitely recognized macroscopically.

Dog 26: Operation, May 7, 1921. Typical operation. Dog still walked with a limp when killed on February 10, 1922. The specimen showed a false joint with fibrous union. There was no remnant of the peg visible macroscopically.

Dog 28: Operation, October 14, 1921. Preparation: shave and iodine at the time of the operation. November 2, 1921: dog well. Skin slightly abraded under the cast. February 8, 1922: dog uses leg well. February 27: dog killed.

#### MICROSCOPIC EXAMINATION

From 9 animals (Dogs 12, 14, 15, 19, 22, 26, 28, 29, and 31) specimens which included the

## SUMMARY OF EXPERIMENTS

Number of dog	Date of operation	Date of death	Duration of post-operative life in days	Cause of death	Post-mortem result	X Rays after operation	General appearance	Terminal condition of pug
	10-16-20	10-23-20		Infection	Negative		Severe infection (not noted)	Engaged
	10-15-20	10-23-20		Ether				
2	8-20	10-20		Shock (?)				
	10	10-20		Infection (?)	Dog was buried		Infection (not noted)	
	10-20	10	3	Infection	Negative		Superficial wound healed closely but site of fracture healed in place No union	Engaged
	10-20	11	30	Killed by ether Superficial infection	Poor	3	Superficial infection caused by cast so severe that dog was killed by ether. There was no bony union. Pug embedded in animal fragments, and body movable in post-mortem. Isthmus like joint	Engaged
3	1-20	10		Shock				
4	10-20	11	30	Peritonitis	Negative Cast still on at death	3	Pain shown when at angle of 45 degrees. Pug disengaged from upper fragment and rotated around it. Later incision, shows capsule. Light amount of motion	Disengaged
	10-20	12-20-20		Ether				
10	1-1-20	10-21	30	Infection	Negative Cast still on at death		Skin broken down and suppuration. No union at site of fracture. Bone pug barely engaged in the two bone ends, the narrow portion of which show some union	Engaged
	10-20	3	8	Infection of chest wall	Poor No union		Dog died of infection of the chest wall. Wound closed. Pug firmly united to cast fragment but it separated from the other. Firm bony union. Skin color and glomer attachment to the bone pug	Disengaged
	11	1-1-21	3	Killed by ether	Dog very active Incision exposed to 45 degrees	3 104 277	Large amount of callus. Pug disengaged from mouth at 45 degrees	Disengaged
	1-1-21	9-2	3	Infection			Wound infected. No union	Disengaged (?)
1-1	10	1-1-21	30-1	Killed by ether	Excellent	102 103 154	Pug had been disengaged but there has occurred a firm union with some callus	Disengaged
	1-4	10	130	Killed in dog fight	Poor	3, 154	Pug cavity at side of bone. No union. Suppuration	Disengaged or broken
10	11	3-4-21		Unknown	Negative Cast still on at death		Wound closed. Translucent looking with extensive overlying of fragments. Firm bony union	Broken
17	11	11		Infection			Wound badly infected and fracture lying in hole of pug. Pug bone pug still held the two ends of the fractured bone in alignment	Engaged
18	11			Ether				
19	8-21	11	270	Killed in dog fight	Unable to see leg time after operation	4, 154	Fragments have become disengaged	Disengaged
20	3-21	7		Infection			Wound badly infected. Pug broken in half at site of fracture. No union between pug and machinery cavity	Broken
21	11	4-8-21		Infection			Wound wide open and infected. Fragments widely apart	Disengaged
	11	10-22	300	Killed by ether	Wounds with union	106 16	Pug not definitely recognized macroscopically. Skin joint with bony union	Disengaged (?)
22	11	11		Shock				

Number of dog	Date of operation	Date of death	Duration of post-operative life in days	Cause of death	Functional result	X Rays Days after operation	Gross specimens	Terminal condition of dog
54	5-12	5-27-22	14	Unknown (see price tag)			Peg was damaged. No infection	Damaged
55	10-25	7-22	273	Killed by ether	Lumps	5	Irregular union at about 60 degrees	Damaged (?)
56	27	10-22	130	Killed by ether	Lumps	144, 204	No remnant of peg visible macroscopically. A false joint with fibrous union	Damaged (?)
57	6-20	6-14-22		Unknown infection not evident			No infection	
58	10-14-22	17	25	Killed by ether	Dead leg well	5-97	Peg broken	Broken
59	10-21-22	10-30-22	9	Unknown			No infection. Peg broken off	Broken
60	11-28-22	3	66	Infection		6	Infection. Damaged	Damaged
61	12-9-22	17-22	30	Unknown			Considerable callus formation. Identification of peg difficult in the X ray	Damaged (?)

junction of the beef-bone peg with the live bone were carefully removed. These sections were decalcified, sectioned, and stained. A special study was made of the material from Dog 12 which was killed 413 days after the operation. The material was typical of that found in the other sections.

Dr D. J. Davis, head of the Pathological Department of the University of Illinois Medical School, was good enough to confirm the following observations:

1. The live bone was everywhere in very intimate and firm contact with the dead bone (peg).

2. The dead bone was invaded and replaced by the live bone. This process was evidenced by the following:

a. Owing to the disintegration of the dead bone its border was made up of a series of irregular bays or depressions into which tongues of the live bone protruded.

b. In the receding shores of the dead bone were noted new blood vessels branching out from the live bone. These vessels were noted to contain blood. Such vessels were not observed in the central areas of the dead bone.

c. The borders of the dead bone contained numerous bone corpuscles which were manifestly alive while the central

areas of the dead bone contained no such corpuscles.

d. Around many of the live bone corpuscles found in the borders of the dead bone were circular areas of new live bone. This indicated that new bone was not only formed by invasion and replacement of the old but by the deposition of new bone around the new blood vessels found in the borders of the dead bone.

e. It seems most probable from the appearances of the sections, that the new blood vessels have invaded the haversian canals of the dead bone.

3. The microscopic sections confirmed the observations made of the gross specimens, viz. that the pegs gradually melt away and are replaced by new bone.

4. There was no evidence that the presence of the dead bone stimulated the growth of pathological tissue of any kind.

#### SUMMARY

The study of these experiments has brought out the following conclusions:

1. That the part of the boiled beef bone peg which remains in aseptic stable contact with the endosteum of its host, surrounded by living bone, becomes solidly embedded in new bone. The peg undergoes gradual absorption



and is replaced by new living bone which later in turn, is absorbed

2 That part of the beef bone which lies between the fragments but not protected by endosteum and not covered by living bone even with aseptic surroundings, undergoes rapid absorption and disintegration and is not replaced by new living bone

3 When one end of the beef-bone peg is not fixed in stable contact with the endosteum, but remains in position there is absorption of both the peg and the surrounding live bone

4. The internal callus when the mechanical fixation holds and is aseptic, is limited by the beef-bone peg and does not bridge the line of fracture. The external callus is markedly lessened. The permanent or definitive callus is inhibited

5 This series of experiments did not produce a single successful anatomical and functional result

6 The causes of failure were

a Infection Infections were very frequent and usually fatal

b Disengagement of the peg, due to  
1 Failure in the mechanical reduction

2 Lack of continued immobilization,

3 Loosening of the repair by absorption of the peg and surrounding live bone

c Disintegration of the peg from absorption at the line of fracture. A repair apparently mechanically perfect, would show a good result as long as the peg remained strong enough to sustain the bone. When disintegration of the peg occurred at the line of fracture a point of mobility would be found

f The end-results were either permanent non-union or lateral union usually in malposition

# DEPARTMENT OF TECHNIQUE

## THE MANAGEMENT OF CICATRICIAL (BENIGN) STRICTURES OF THE OESOPHAGUS<sup>1</sup>

By PORTER P. VINSON M.D. ROCKEFELLER, M.D.  
Section on Medicine, The Mayo Clinic

### ETIOLOGY

CICATRICIAL structures of the oesophagus may result from any inflammatory reaction in or around that organ. The most common cause of these benign strictures, however, is the accidental or suicidal ingestion of a solution of household lye, which even in exceedingly small quantities and very greatly diluted often produces enough ulceration in the oesophagus to result in a cicatricial stricture (Fig. 1). Children are more often affected with this type of stricture, but it is also commonly seen in adult life. Many of the adults, however, have received a burn from the caustic in childhood, and do not develop marked dysphagia until later in life.

Benign strictures may also follow the swallowing of strong acids or the long retention of a foreign body in the oesophagus, and have also resulted from the vomiting of pregnancy in nine patients observed in the Clinic. Ulceration in the oesophagus, with resulting stricture, may occur during the course of typhoid fever. Mediastinitis secondary to pneumonia, a suppurative appendix or other infections, may involve the oesophageal wall to such a degree that the healing processes produce stricture. A few cases of oesophageal stricture have occurred during the course of scarlet fever two having been observed in the Clinic.

A considerable number of cicatricial strictures of the oesophagus occur without any evident cause. The majority of these are probably secondary to an unrecognized low grade peri-oesophagitis. Simple acute oesophagitis with superficial ulceration only rarely results in the formation of strictures.

### DIAGNOSIS

The diagnosis of benign strictures of the oesophagus is, of course not difficult in cases in which there is a definite history of previous trauma in the oesophagus but in those without such a history the differential diagnosis may be more difficult. Malignant stricture is practically the only lesion that may cause confusion, but the symp-

toms of dysphagia with this type of obstruction are usually of shorter duration than is the case with benign stricture. Roentgenographic examination and a careful oesophagoscopy will ordinarily settle the diagnosis. Syphilis and tuberculous of the oesophagus occur very rarely and may be disregarded for practical consideration.

### TREATMENT

The treatment of benign oesophageal strictures consists of mechanical dilatation with graduated sounds, using a previously swallowed silk thread as a guide (Figs. 2 and 3). Under ordinary conditions, the thread is started 24 hours previous to the time of the dilatation and is cut off and allowed to pass through the intestinal tract after the dilatation has been carried out. Five yards of button-hole twist size D is swallowed during a period of 24 hours, care being taken that the thread enters the stomach very gradually. If swallowed too rapidly the thread will snarl and not permit the free passage of the dilating olives. At the end of 24 hours, the thread will have passed far enough into the stomach and intestines to permit of its being pulled perfectly taut without relaxation. By means of this simple guide, sounds can be safely passed through the stricture. Failure to swallow the thread is almost always due to lack of faith in the method, on the part of the physician, or patient. The thread will pass through the stricture whenever an opening exists. Perseverance is often necessary but is always rewarded by greatly increased safety in instrumentation (Fig. 4).

In very young children, it is occasionally necessary to put a catheter through the nose and to force the thread through this into the stomach by means of a syringe and small amounts of water. It is seldom necessary to resort to gastrostomy in these cases, but when it has been performed previously the thread is swallowed in the usual way and, becoming entangled on the gastrostomy tube, can be brought out through the abdominal fistula. A heavy bass line is then tied to the lighter thread



Fig. 2. Specimen of the esophagus showing cicatricial stricture due to walling off of it. The patient died from pellagra. Note the sacculations in the lower third of the esophagus. An attempt to pass an esophageal dilator might lead to fatal result in such a case.

and pulled through the gastrostomy opening. Dilatations can then be accomplished by pulling sounds into the stomach. The brass line is left in the esophagus constantly, but should be renewed frequently as it deteriorates rather rapidly. When ever much difficulty is encountered in getting a

thread through the stricture it should not be cut off at each dilatation, but a heavy silk thread should be tied to the smaller one, and can be kept in the esophagus for months at a time. A small

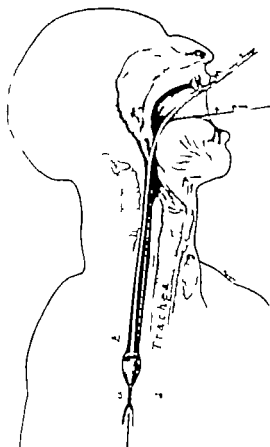


Fig. 1. Method of measuring the distance of the stricture from the incisor teeth.

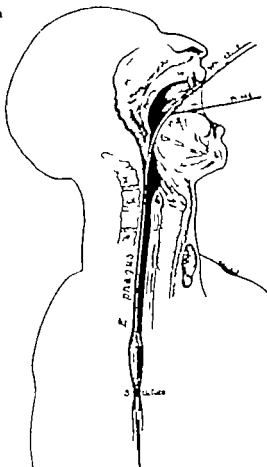


Fig. 3. Dilating sound graded on previously swallowed silk thread.



Fig. 4. A child, aged nineteen months, with stricture of the oesophagus resulting from ingestion of solution of lys. No difficulty was experienced in swallowing the silk thread.

amount is swallowed each day and a portion must be cut off at every movement of the bowels.

In cases in which lye has been swallowed, the ordinary antidotes and supportive measures should first be employed, after which the patient should swallow a thread as soon as possible. Dilatations should not be carried out until dysphagia exists to a considerable degree, usually 6 or 8 weeks after the accident. The dilatations should be very gradual, and not more than one or two sounds passed at each stretching. The time between dilatations should be lengthened as rapidly as possible. It may be necessary to repeat them once a week for 3 or 4 weeks, after which the interval can be increased to 10 days, and then to 2 weeks. Finally it becomes unnecessary to pass sounds more than once or twice a year. A sound should be passed at least once a year for 1 or 3 years, even though there has been complete freedom from dysphagia. Cicatricial strictures from other causes are treated in essentially the same manner as those caused by ingesting lye.

Most strictures can be dilated to 30 F. at the time of the first stretching, and almost all of them can be dilated to 45 F. within the first year. The sounds are increased by one or two sizes at each



Fig. 5. Piano wire passed through stiff metal leader to be used for dilating cicatricial strictures when difficulty is experienced in swallowing the thread.

dilatation depending on the ease with which the stricture can be stretched. Excessive trauma should be avoided as this simply increases the inflammatory reaction and prolongs the period necessary for treatment. Very dense resistant strictures are encountered at times, and it may be necessary to cut the stricture by a modification of the method originally devised by Abbe. Complete closure of a benign stricture may be caused by lodgement of a foreign body and whenever this occurs the foreign body should be removed by oesophagoscopy. If the condition of the patient does not warrant the delay occasioned by the swallowing of the thread, a small piano wire with a tiny brass ball on the end may be passed through the stricture into the stomach, and the first dilatation can be given, using the wire as a guide (Fig. 5). This procedure is seldom employed as it entails more risk than when the thread is used in the usual way. Complete stenosis of the oesophagus should not be allowed to occur but if it does the condition is practically hopeless so far as restoration of the lumen of the oesophagus is concerned. Anaesthesia should rarely be used when dilating any type of oesophageal stricture.

#### RESULTS OF TREATMENT

The results obtained from the treatment of benign oesophageal stricture by the methods described have been quite satisfactory. Complete and permanent relief from dysphagia is always obtainable if dilatations can be carried out for long periods of time. This frequently necessitates training the patient, or some member of the family to make the dilatations, but with the simple thread technique this is usually accomplished easily.

It has been necessary to perform gastrostomy in only two cases of benign stricture at the Mayo Clinic during the past 6 years. In one of these, there had been a previous perforation into the left bronchus from blind instrumentation.

There is very little risk in dilating a benign stricture of the oesophagus if the sound is passed on a thread.

One hundred twenty-four patients suffering from benign oesophageal strictures have been

treated in the Clinic since January 1917 and there have been six deaths following instrumentation. The patients have averaged about ten dilatations each while under our care.

None of our patients has developed malignant degeneration in the scar tissue and in only one of our patients with carcinoma of the esophagus was there a history of a previous benign stricture.

#### CONCLUSIONS

1. The majority of cicatricial strictures of the

esophagus are caused by the ingestion of solutions of household lye.

2. Practically all cicatricial strictures of the esophagus can be cured by dilating with graduated dilators.

3. The dilatations can best be effected by using a previously swallowed silk thread as a guide.

4. Gastrotomy is seldom necessary and involves a definite risk in treatment.

5. Malignant degeneration in a cicatricial stricture of the esophagus is rarely encountered.

## CYSTOGRAMS THEIR CLINICAL APPLICATION AND POSSIBLE MISINTERPRETATION

Dr HERMAN C. BUMPUS, J. M.D. ROCHESTER, MIN. 9074  
Section on Urology, Mayo Clinic

WITH the accurate interpretation of pyelograms a differential functional test and a catheterized specimen of urine from the ureter, the diagnosis of a pathological condition of the kidney is seldom doubtful. The cystogram however has not proved to be of equal value possibly because the interior of the bladder is more readily brought under observation and more accurately interpreted through the cystoscope than from a roentgenographic plate. Yet the cystogram serves as a valuable adjunct to the cystoscope and if the possibility of its misinterpretation is appreciated, may give information obtainable in no other way. I shall direct attention here to some of the more common of these sources of error and present the types of cases in which cystograms are of the greatest aid in diagnosis.

**Diverticula of the bladder.** The cystogram reveals not only the position of the sac but also its capacity, and if an additional plate is made after the bladder has been emptied it will reveal whether the diverticulum also empties or acts as a receptacle for residual urine. If there are multiple diverticula, those that may have been overlooked due to the inconspicuousness of their openings in a markedly trabeculated bladder are revealed. The diverticula that empty and are therefore non-surgical are differentiated from those that return their fluid and must be resected.

**False diverticula.** A possible error in connection with the interpretation of cystograms is to mistake for a large diverticulum a portion of a greatly relaxed bladder that has been compressed in the

center by extravascular pressure. Such error in diagnosis occurs because the shadow cast by the dome is projected by the rays in a position which appears independent of the main part of the bladder and gives the impression of a diverticulum nearly equal in size to the bladder (Fig. 1). This is most likely to occur in cases of prostatic obstruction in which the relaxation of the dome is the most characteristic deformity and if rayed from a certain angle will appear not as an extension of the bladder but as an independent diverticulum. A diverticulum located in the base of the bladder so that the shadow of the bladder completely obliterates the diverticulum is also misleading but incorrect interpretation may be avoided if the proper technique in exposing the plates is followed (Fig. 2) or if a lead catheter is coiled in the diverticulum (Figs. 3 and 4).

**Urethral diverticula.** Urethral diverticula are often a puzzling problem to the cystoscopist, for while the opening is readily noted it may be impossible to detect the depth of the sac and its extension. If such a diverticulum is filled with an opaque fluid of a different density from that used to fill the bladder a contrast roentgenogram, showing the anatomical position of the urethral diverticulum will be obtained.

**Tumors of the bladder.** Malignant growths in the bladder are usually discovered by the cystoscope but because of bleeding secondary infection, intolerance, or position, it may be difficult to determine their exact extent. In such cases a cystogram will usually show by the filling defect present (Fig. 5) whether the growth is resectable or must be treated by palliative measures, such



Fig. 2



Fig. 3



Fig. 4



Fig. 5



Fig. 6



Fig. 7

Fig. 2. A false diverticulum produced by the compression of the center of the bladder and the shadow of the dome being projected over that of the bladder itself (Case A43-99).

Fig. 3. A large diverticulum, the shadow of which is thrown clear of the bladder by tilting the roentgen tube all to one side of the pelvis. This diverticulum might have appeared as part of the bladder if the picture had been taken directly from above. (Case A360528).

Fig. 4. Shadow of bladder completely obscures diverticulum containing lead catheter shown in Figure 4. (Case A37933).

Fig. 5. Lead catheter coiled in diverticulum that is obscured by the shadow of the bladder in Figure 5. (Case A37933).

Fig. 6. Tumor of the bladder. Extent of infiltration in all of the bladder which demonstrates its inoperability. (Case A304030).

Fig. 7. Filling defect resulting from blood clots associated with tumor of the bladder giving an erroneous idea of the extent of the tumor. (Case A434900).

Fig. 8. Elevation of the base of the bladder and marked trabeculation and relaxation of musculature, the result of prostatic hypertrophy. (Case A436567).

as roentgen-ray or radium. In this connection care must be taken to exclude blood clots as a cause of filling defects (Fig. 6) for if the tumor bleeds freely sufficient clots may form to produce a filling defect that will give an entirely erroneous impression of the extent of the malignancy.

**Prostatic hypertrophy.** If a diagnosis of prostatic hypertrophy has been made by rectal palpation

and confirmed by the finding of residual urine there is usually no necessity for cystoscopic examination, which results mainly in the detection of coincident diverticula, or stones. The presence of stones will usually be demonstrated by the roentgenogram (Fig. 7). A routine cystogram will demonstrate the presence of diverticula and of residual urine, which may have escaped



Fig. 8



Fig. 9



Fig. 10

Fig. 8. Normal cystogram. Slight elevation of the base of the bladder obtained from patient with prostatic hypertrophy. Hypertrophy not demonstrated by cystogram. (Case 134296.)

Fig. 9. Cystogram showing marked bilateral pyelonephritis that has resulted in marked dilatation of both

ureters, with associated reflux to pelvis of the kidney. (Case 13230.)

Fig. 10. Cystogram revealing reflux up single ureter with marked trabeculation of the bladder in a case of lesion of the spinal cord resulting in stony of the urinary tract. (Case 135058.)

detection when the first test was made. If however the patient gives a definite history of prostatic disease and rectal palpation fails to show an enlargement of the gland in proportion to the symptoms a cystogram will not afford reliable information concerning the intra-urethral enlargement of the prostate. Often cystograms in cases of considerable intravesical enlargement

show no elevation or filling defect of the base (Fig. 8) while patients with but slight intravesical enlargement show considerable elevation, due probably to distention of the lower bowel by gas or feces.

*Reflex reflex.* The knowledge that urine from the bladder passes up the ureters to the kidneys is often of great clinical importance, and this is most readily demonstrated by a cystogram taken in the Trendelenburg position. Such reflux often occurs in patients suffering with bilateral pyelonephritis (Fig. 9) and lavage of the renal pelvis may be easily accomplished simply by filling the bladder with the lavage solution desired, and elevating the patient's buttocks. Such lavage eliminates the necessity for cystoscopic examination and ureteral catheterization, which is a great relief to the patient. Instead of washing the renal pelvis once or twice a week, as would be the case if a cystoscope were used, it is done as often as desired, with much better ultimate results. In the most advanced cases it is, of course, possible to detect with the cystoscope the urine from the bladder as it regurgitates up the ureter but in

the earlier cases the apparently normal ureteral meatus is often incompetent and if routine cystograms are taken in cases of pyelonephritis the reflux will be discovered. In 114 such cystograms the reflux was noted in twenty-one.

*Disease of the central nervous system.* In cases of disease of the central nervous system reflux often occurs, and is easily overlooked if cystograms are not made. Of seventy patients with disease of the central nervous system who were examined by the cystogram seven had a reflux of the cystographic medium up the ureters. Usually the reflux is on both sides, but in some instances the atonic condition of the urinary tract is on one side (Fig. 1) and the removal of the diseased side results in a normal. As in cases in which the dilatation of the ureter is due to infection, so in these cases in which it is due to loss of tone the result of nerve injury the ureteral orifices may not indicate their incompetency. It is, therefore, important to make routine cystograms when trabeculation of the bladder or relaxation of the sphincter indicates a central nervous system lesion.

*Congenital anomalies.* In the diagnosis of congenital anomalies of the urinary tract the cystogram is most useful, since often there is dilatation of the entire urinary tract especially in cases in which there is some form of obstruction in the posterior urethra, a condition which occurs in children (Fig. 1).

*Renal tuberculosis.* In cases of unilateral renal tuberculosis that have resulted in a rather exten-



Fig.



Fig.

Fig. 1 (left) Reflux up an enormously dilated ureter in case of congenital stricture of the urethra in child (Case A348044)

Fig. 2 Reflux up the ureter of the normal kidney in case of unilateral renal tuberculous and tuberculous cystitis the result of the production of the so-called golf hole nectus (Case A903068)

in tuberculous cystitis, the urine from the bladder flows up the ureter of the unaffected kidney while the structured ureter on the diseased side usually prevents the flow upward (Fig. 12)

In a series of sixteen cystograms in cases of urinary tuberculosis, reflux occurred in seven, in five of which it was up the unaffected side in the remaining two up both sides

#### TECHNIQUE

In making cystograms the bladder should be filled with one of the usual pyelographic mediums. Sodium bromide 16 per cent, or potassium iodide 12 per cent, may be used they are both inexpensive and easily prepared. The potassium iodide seems preferable as at 12 per cent it is isotonic and casts a good shadow. These salt solutions however have a slight irritating effect and if patients have considerable cystitis, silver iodide emulsion 5 per cent is more satisfactory because of its mechanical qualities. It also casts

a denser shadow and is very soothing to the inflamed mucosa. After the bladder is filled the urethra should be compressed with a penis clamp or tight bandage, and the first picture taken directly above the symphysis, so that the outline of the bladder will be thrown clear of the sacrum. Two other pictures should then be taken with the roentgen tube tilted so that the first picture is projected to the right, the second to the left. By such means diverticula that are near the base of the bladder and might be obscured by the shadow of the bladder in pictures taken directly from above are thrown so that their shadows fall along the periphery of the bladder and thus are brought into view (Fig. 3). The fourth plate is taken like the first the bladder having been emptied either by voiding or by a catheter this plate will disclose diverticula that do not drain, and, also if the bladder first has been emptied by voiding, will reveal the amount of residual urine that is present.







Fig. 2 and 3 Application of skate

remain. The whole dries in a few minutes so that the skate becomes an integral part of the foot itself. The other parts of the skate, which steady the foot and control its position may now be attached.

The small bolts projecting from the plate attached to the foot, slip through holes in the ends of a flat steel bar which is then made fast by adjusting small wing nuts upon the bolts at heel and toe (Fig. 3). This flat bar has a long slot carrying in it two small, loose bolts with wing nuts. The upper one of these bolts, that nearer the toes, serves for the attachment of the supporting crossbar which rests upon the side bars of the splint (see illustrations).

There are two of these supporting crossbars with the skate, one flat with a slot at the middle and the other a round rod, both being furnished with cotter pins in small holes at the ends. Of these bars the flat one is intended for use when the foot is to be kept rigidly fixed (Figs. 3 and 7) and the round one is used for mobility in traction or for active motion at the ankle (Figs. 4, 5 and 6).

In the case of the fracture under consideration the round crossbar is the one of choice. To attach it to the skate a small clamp is provided which will grip the middle of the round rod between its jaws. The jaws furnish two grips, plates, in one of which the round bar is held tightly, in the other loosely. The clamp is pierced by a hole which allows it to be bolted to the skate (Figs. 4, 5, and 6).

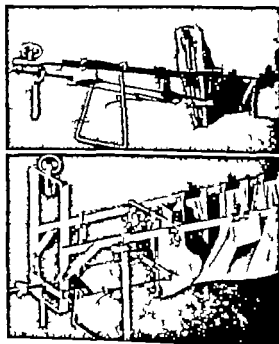
When the cross rod has been clamped to the skate with its ends resting upon the side bars of

the splint the rotation of the foot with respect to the leg is under control and also its position anteroposteriorly in relation to the splint.

The short crossbar should, next, be attached to the as yet unused bolt in the long slotted bar of the skate. This short bar should be placed at a point horizontally in line with the malleoli and the wing nut tightened. It is to the ends of this bar that the traction is attached.

Traction is next applied either by tractor as illustrated which is convenient and effective, or

Vergason R. M. A screw tractor for use with Thomas' splint. J. Am. M. Ass. Nov. XXV, 1906.



Figs. 4 and 5 Skates applied for extension

In place of the strips of gauze bandage, a heel sock may be used. The sole plate is first put in the sock, holes being cut at toe and heel for the toes to pass through. The padding necessary to put on the sock may be provided to the patient, if so the sock should be slit down the front in such case. It is much better than the gauze strips. It is much better to the number of socks with the collared and get firm adhesion (that with gauze). In the case of an elderly woman with comminuted fracture of the femur and very tender skin the writer employed a stocking extending above the knee. The whole stocking was glued on with collared and was perfectly well tolerated under traction for over a week. It was only necessary to cut holes in the stocking over the external malleoli where slight skin irritations appeared.



Fig. 6

Fig. 6 (left) The clamp plates may be adjusted so that their slots are oblique instead of horizontal.



Fig. 7

Fig. 7 A second wire pan with detachable heel cup for use in maintaining dorsal flexion without traction applied to foot itself.

by attaching the traction crossbar of the skate by a cord directly to the end of the splint, or by means of a weight and pulley. The amount of traction, of course, should be sufficient entirely to overcome the muscles and any overriding of fragments. A common error is too weak a pull which is fostered by the adhesive plaster method of attaching traction to the leg. With the skate as a part of the foot the full force of the pull is applied to advantage and there is no loss due to slipping plaster skin and muscles which always occurs when adhesive plaster is used.

When the traction has been adjusted the side clamps of the skate can be attached. There are two of these, their purpose being to fasten the supporting crossbar of the skate to the side bars of the splint.

Each clamp consists of a bolt, with wing nut upon which are strung four loose members. Two of these members are grooved near one end and serve as the jaws for gripping the side bar of the splint. They are separated by a third member or key which enables them to grasp round rods of varying sizes and also to keep them apart and parallel should they be required to grip a splint the side bar of which is flat (Fig. 5). The fourth member on the bolt is a thin flat plate having rounded corners, a short slot where the bolt passes through and, near its ends, several other perforations in some one of which the end of the crossbar of the skate will be retained. The T-shaped opening at one end of the plate will take the end of the flat crossbar of the skate. At the other end of the plate is a comparatively long transverse opening

which would be the one of choice for the round crossbar.

To apply one of the clamps the jaws are first arranged opposite each other with the key evenly between them on the side away from the bolt. These are held in this position with one hand while the other hand adjusts the thin plate over the end of the crossbar from which the cotter pin has been temporarily removed. The jaws of the clamp are next separated enough to grip the side bar of the splint and the wing nut is tightened, thus locking the clamp. The other clamp is then placed in a similar manner (see illustrations).

With the ends of the round crossbar in the slot-like openings of the clamps the foot is allowed considerable play but by altering the position of the clamps on the splint and by adjusting the plates of the clamps at the proper angles any undesirable movement of the foot may be prevented. Play of the crossbar in the clamps is necessary under traction and as the traction crossbar is always posterior to (heelward of) the supporting crossbar the tendency of the pull is to force the foot toward dorsal flexion, the crossbar in the clamp plates acting as a fulcrum. Should this tendency toward dorsal flexion be undesirable the clamps may be set slightly further down the splint (distal) so that the crossbar rides in the upper (proximal) ends of the slots. So arranged the traction can move the whole foot down until the crossbar has traversed the length of the slots which, if the pull is sufficient, will be accomplished in twenty-four hours when the clamps may be moved down the splint again and made to hold the increase

In length thus obtained. Moreover the clamp plates may be adjusted so that their slots are oblique instead of horizontal (Fig. 6) producing a tendency for the crossbar to slide down the incline displacing the foot in the direction of traction. If due to tipping of the whole splint and consequent sliding of the supporting crossbar a tendency is noticed for the foot to move bodily sideways, the crossbar should be set over in the direction of this tendency as far as it will go i. e. until the cotter pin bears against the clamp plate on the high side. The cotter pin prevents the end of the crossbar from slipping out of the clamp.

The position of the foot is now entirely under control. Its position anteroposteriorly and laterally in the splint, and its internal or external rotation are controlled by the central bolt of the supporting crossbar. Pronation or supination can be obtained by setting one of the side clamps further up the splint than the other thus placing the skate and foot in an oblique position in the splint. The amount of dorsal flexion can be increased by setting the traction crossbar nearer the heel so that the ankle joint becomes the fulcrum.

In some cases it is necessary to hold the foot perfectly still in a certain position and in such cases, the flat crossbar of the skate should be used. With this, positions of dorsal or plantar flexion are provided for by inclination of the clamp plates (Fig. 3). With either crossbar any position or combination of positions can be obtained.

A second sole plate or pan, with a detachable heel cup is furnished with the skate. This is for use when it is desired simply to maintain dorsal flexion without traction applied to the foot itself (Figs. 1 and 7). This sole plate is convenient when traction is applied by means of adhesive plaster stickers. Here again the flat crossbar maintains steady position and the round one allows active motion at the ankle.

#### SUMMARY

Maintenance of the foot in proper position is a problem invariably present in fractures of the lower extremity.

With compound comminuted fractures near the ankle and open splint methods of treatment the problem is particularly difficult.

To meet the varying requirements of different cases, splints and traction methods a skate has been devised and its use here described.

The skate properly attached to the foot with celluloid allows leverage as well as traction to be applied with all the effectiveness and none of the dangers of the heel pan or the Finocchetto stirrup.

The skate will hold the foot in any position or combination of positions, with or without motion, with none or with any method of traction desired and in splints the side bars of which are either round or flat.

It is hoped that the skate will prove as valuable to others as it has to the writer.

VARIOUS METHODS OF FINISHING A PLASTER-OF-PARIS CAST<sup>1</sup>

By PHILIP LEWIN M.D. CHICAGO

Attending Orthopaedic Surgeon, Cook County Hospital, Junior Attending Orthopaedic Surgeon, St. Luke's Hospital, Assistant Professor of Orthopaedic Surgery, Northwestern University Medical School

ALTHOUGH the inside of a plaster-of-Paris cast is of the greatest importance this paper deals with various methods of finishing a cast. It is a point in plaster-of-Paris technique.

A brief summary of the best known methods in general use follows:

1. *Calot's method* A heavy layer of thick plaster cream is carefully smoothed as a plasterer builds a wall. The final result is accomplished by delicately going over the cast with a large piece of wet cotton. Having had a special course under Dr. Calot, the writer can testify to the beauty of his casts.

*Comment* Often the outer layers crack, especially near the edges.

2. A wet plaster bandage used as a "rubber" or "ironer."

3. A hard rubber roller similar to the roller used by wall paperers to obliterate over lapping edges.

4. Dusting on plaster powder like talcum powder and rubbing it in.

5. Dusting on talcum powder and rubbing it in.

6. Two coats of shellac or varnish on a dry cast. This is especially valuable in spica casts in small children who soil them.

7. Celluloid dissolved in acetone as a thin cream painted on a thoroughly dry cast.

8. Stockinet covering of entire cast. This is expensive and takes considerable time on the part of the nurse.

9. Tacking the stockinet, using small tacks which run into the plaster.

In 1919, while engaged in postgraduate work at the University of Paris, my attention was directed by Dr. B. W. Moffat, of Red Bank, New Jersey to the following method of finishing a cast. It was demonstrated to us by Professor August Broca's plaster nurse at Hôpital des Enfants Malades. She learned it from an orderly many years previously. The method consists in applying a single sheet of dry crinoline to the cast and rubbing it in. When I returned to America in July, 1919 I modified the routine slightly as out-



Fig. 1



Fig. 2



Fig. 3



Fig. 4

Figs. 1 and 2. Unfinished plaster cast.  
Figs. 3 and 4. Illustrating the roughest on exposure of the cast is stockinet. One double length piece of the ma-

terial may be used for this purpose. (A sheet is wound around the patient's thighs and secured by an elastic webbing band.)

From the Orthopaedic Department of St. Luke's Hospital.



Fig 5 A removable plaster-of-Paris jacket applied to case of multiple fractures of lumbar transverse processes, 5 weeks after accident. When the cast is dry and trimmed to comfort, it is cut down the front removed, and bandaged. The brace maker applies the steels, leather and lacings

med below and have used it in several hundred casts with gratifying results

#### TECHNIQUE

- 1 The last plaster bandage must be creamy
- 2 Quickly apply a sheet of dry crinoline and rub in thoroughly especially the edges which must not be curled over or under

- 3 When the plaster is about to set, use a rolled up strip of wet plaster bandage as a shoe shiner. If the last bandage is not creamy make up in a small bowl some thin plaster cream and impregnate the crinoline with the plaster and apply. If any windows are to be cut out, plaster ropes may be used to outline them and reinforce the edges before the final dry crinoline layer is applied

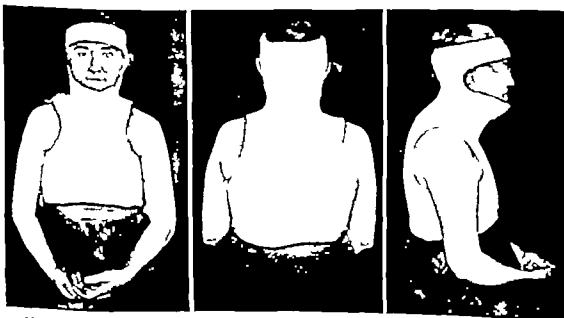


Fig 6 Illustrating the type of cast indicated in cervical or upper dorsal tuberculous, osteoarthritis, or injury

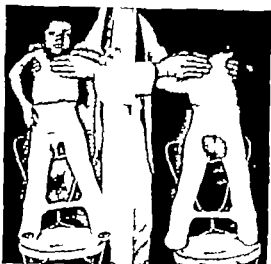


Fig. 7 Double space cast with cross bar which is of great aid in handling the child. He is raised by placing one hand behind the neck, and the other on the cross bar. Cast applied to case of osteogenesis imperfecta with open fracture produced by osteoclasts (osteoclasts) previous to taking this photograph.

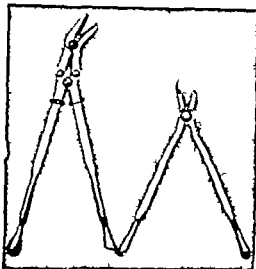


Fig. 8 Plaster cutter and plaster spreader.

ous mass of it instead of a series of layers like an onion.

The date in indelible pencil should be marked

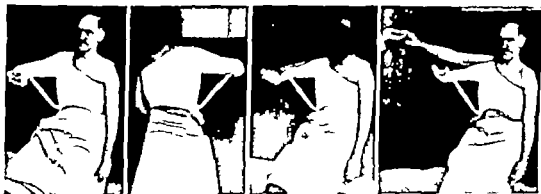


Fig. 9 Illustrating space of the right shoulder used in maintaining abduction. (N external rotation as indicated in this case.)

Fig. 10 Same cast as in Figure 8 made into shelf splint preventing adduction but permitting abduction.

The advantages of this method are: (a) It adds one layer of strength. (b) It never cracks as Calot's might. (c) It keeps the patient on the table or frame from 10 to 30 minutes longer thereby minimizing the danger of cracking the cast, especially in a space of the hip. (d) It encourages rubbing the plaster cast so as to make one homogeneous

on every plaster cast. An outline should be made with indelible pencil, of windows to be cut out such as in scabious jackets, over operative wounds, over abscesses, etc.

The author desires to thank Dr. J. L. Porter, several of whose patients are shown in these illustrations.

THE SMALL DEEP GRAFT<sup>1</sup>

## EXPERIENCES AND RESULTS OF THE LAST THREE YEARS

By OCTAVE CHARLES CASSEGRAIN A.M. M.D. NEW ORLEANS

Department of Surgery Tulane University of Louisiana School of Medicine

SKIN grafting furnishes one of the most romantic pages in the history of surgery not because of the difficulties the early surgeons had to overcome for that is the story of all medical achievement but because in no other field of medicine perhaps did the imagination of the physician have such play.

From the earliest times, surgeons realized the need of covering large areas denuded of skin and in their perplexity tried every available material from parts of the amniotic sac to the lining membrane of eggs and the skin of animals, such as sheep, frogs, and dogs. Success followed in one or two instances, but successive trials repeatedly ended in failure.

It was only with the coming of the autograft that skin grafting may be said to have been a successful procedure. And to Reverdin, who in 1869 introduced his pin graft and Ollier and Thiersch who independently in 1886 introduced the graft which bears their name must go the credit for placing skin grafting on a practical working basis. Today with the exception of the few cases where skin is removed from donors whose blood is of the same group as the recipient all skin grafts are taken from the patient himself.

Up to the fall of 1920 skin grafting was to me a very distasteful operation, necessary at times, it is true, but done always with a feeling of pessimism as to results, which was all too often justified. About that time, however, John Staige Davis described a graft which he called the small deep graft and we decided to experiment with it. Our first attempt was so successful that we were encouraged to try again. Since that time we have used it with much success in almost all our cases of denuded skin areas where the larger flap operations were not indicated and in three instances in conjunction with the flap operations and I have come to look forward with pleasure to an opportunity of performing this operation.

We have used the small deep graft chiefly to hasten healing following the radical removal of tumors for malignancy, in extensive burns and in the various types of traumatic wounds of the extremities that are admitted to our service at Charity Hospital. We believe that it is preferable to graft granulating surfaces rather than fresh

raw surfaces, because in the former vascularization takes place more quickly. We prepare the receiving surface in the following way:

The morning before the operation the area to be grafted is cleansed and an alcohol dressing applied. On the morning of the operation it is thoroughly bathed with warm saline solution. Scraping or shaving of the surface with curette or scalpel is absolutely contra-indicated for if the surface bleeds, efforts to control the ooze by hot saline compresses devitalize the surface and often result in failure. If the surface appears non-succulent or fibrotic it is permissible, I might better say advisable to rub it gently with gauze moistened with warm normal saline.

The small deep graft is essentially a whole thickness graft and unlike the Reverdin, which is an epidermic graft, includes all the layers of the skin down to the subcutaneous fat. The area from which the grafts are removed resembles small pits, and fat is always seen at the bottom of the pit showing the depth to which we cut to obtain the graft. The diameter of the graft varies in size from that of a lead pencil eraser to that of a dime but the diameter of the ideal graft should be half way between the two. The simplicity of obtaining the graft is one of its recommendations, though not the chief. There is no need here of a sharp razor of a perfectly steady hand skilled in barely shaving the top of the papillae; there is no tedious uncurling of the rolled up edges of the graft but instead, a long Keith needle and ordinary scalpel are used. The needle is passed through the skin which is elevated in the form of a cone, the base of which is then cut through with the scalpel and placed on the raw surface to be covered.

Children and highly tumorous persons excepted all skin grafting should be done under local anesthesia, but we have found that infiltration of the skin to be transplanted devitalizes it to a variable degree. For this reason we have developed the following technique. After preparing the donor skin by first scrubbing with alcohol, we map out a rectangular area, usually on one of the thighs, and infiltrate the skin and loose connective tissue along the proximal and two lateral sides. This gives us a central area anesthetized but uninfil-



trated, from which we pick our grafts. The grafts are then placed on the receiving surface from one-fourth to one-sixth of an inch apart and then pressed into place with wet gauze and covered with five or six thicknesses of gauze dipped in normal saline. This first dressing is held in place by adhesive plaster to prevent any shifting of the gauze which might dislodge the grafts before they have become adherent. Plain dry gauze is then added and the dressing completed with a roller bandage. The dressing is undisturbed for 4 days and removed on the morning of the fifth day. In removing the dressing there is but one precaution to observe, but it is a very vital one. The dressing should be first thoroughly soaked with alcohol or normal saline and removed in layers until only one last strip of gauze is left over the grafted surface. This last strip can then be removed with impunity. Unless that precaution is observed, some of the grafts, even though they have taken, will of necessity become detached, due to the caking and stiffness of the dressing to which they adhere and from which they have not been separated by this gradual removal of the dressing. After the dressing is entirely removed a thin layer of epidermis can be seen branching out from the edges of the grafts and filling the space between them, and frequently the whole grafted surface is covered by a coagulated serous ooze which might easily be mistaken for this pus.

The surface is cleaned with alcohol, dried and covered with adhesive plaster. Adhesive plaster is used for its stimulating and conductive properties. The wound is dressed daily or every other day adhesive plaster and dry gauze being used alternately until epithelization is completed. After 7 days, unless there is a contra indication, we have the patient take a warm bath daily for its stimulating effect on epidermization.

In the cases reported below the grafting was not all done by myself but every man on the service including two of our internes, operated on at least one patient.

Our best and quickest results, as might well be expected, were obtained in grafting granulating surfaces following the wide excision of malignant tumors for here we dealt with tissues undevitalized by trauma and infection. Our next best results were in the treatment of burns and ulcers. In those types of cases we did not have a single complete failure and all but one case were absolutely satisfactory.

In our male service we used the small deep graft on eight patients. Three of the patients had had extensive crushing and lacerating injuries, and debridement was done on admission. Their

average stay in the hospital was 2 months. Their average stay after grafting was 38 days. The shortest stay was 11 days, the longest, 60. In two of the cases the grafting had to be done twice for all of the grafts did not take. These 2 patients, however, had suffered horrible mutilations and in neither case did we lose all our grafts. In our other cases, three osteomyelitis, and one sarcoma of the thigh the grafts were satisfactory, and the patients were discharged in from 17 to 35 days from the time of grafting. Our only complete failure was in a boy 7 years old, who had suffered an evulsion of the heel and plantar surface of the foot. The flap was sutured in place in the Accident Room, but sloughed a few days later. Three attempts to cover the heel were made. Two Wolf Kraus grafts failed, and the third and last attempt with the small deep graft was also unsuccessful.

In our female service all but three of our eleven cases were grafted following radical breast amputation and in these the average number of days that elapsed from the day of grafting to the day of discharge was 14 days, the smallest being six, and the greatest twenty nine. One patient who had forty-five small deep grafts, all nearly as large as a dime, placed on a large granulating surface, the result of an extensive breast amputation, was discharged 11 days after operation, healed.

In the case of the woman who remained 29 days, an overzealous interne, mistaking the normal wound secretion of which I spoke previously for infection, dressed the grafted surface with dichloramine-T. Two days elapsed before we discovered the mistake. Much to our astonishment, however every graft was in place and had resisted the corrosive action of the drug, but the surface was bleaching, angry looking, and all the fine sprouts of epidermis had of course been destroyed.

Of our three other cases two were grafted for burns and one for luetic ulcer. The ulcer was grafted on June 8 and epidermization was complete on the 30th, that is, in 22 days. Our burn case was grafted on June 1 and epidermization was complete on the 14th. The third case I will not report as Ober Thierich grafts were used.

#### CONCLUSIONS

In conclusion, therefore we wish to state that we have found

That the small deep graft is by far the easiest type of graft to obtain.

2 That it is the most viable, as evidenced by our experience in the case where the dichloramine-T was used.

3 That being a whole thickness graft it is not only firmer and more resistant than the epithelial graft, but is especially useful in the grafting of exposed localities, such as the heel or shoulder where on account of pressure a thin graft will not stand the strain

4 That even in the cases where all the grafts

did not take there was undoubtedly a distinct stimulating influence exerted on the granulating surface which hastened its complete epidermization

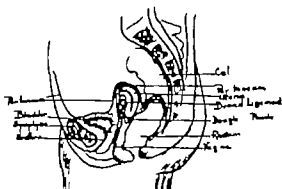
In closing, I wish to thank D. H. B. Gessner, our chief of staff, for granting us the use of the material from his ward

## AN OPERATION FOR THE CORRECTION OF PROCIDENTIA OR MARKED CYSTOCELE AND RECTOCELE

BY NORMAN D. MORGAN, M.D., SAN FRANCISCO  
Gynecologist, Mary Help Hospital

THE following operation is a very simple method of correcting a common disorder known as prolapse of the uterus or procidentia and is especially adapted to patients who have passed the menopause.

After making necessary repairs of the cervix and perineum, the abdomen is opened with a suprapubic median incision. The ovaries and tubes are inspected and dealt with in the usual manner. The intestines are blocked with laparotomy sponges. The tubes and ligaments are separated from the uterus as is done in performing hysterectomy. The bladder then is dissected back and the peritoneum on the posterior wall of the vagina is dissected off down to the bottom of the cul-de-sac. The uterus is freed from all its moorings except inferiorly where it is still attached to the superior vagina. The uterus is held anteriorly while the two free ends of the round ligaments are sewed together behind the uterus, but the uterus is still left free. The ligaments must be sewed in such a way that they will form a firm, tight ridge behind the uterus. The uterus is pulled up, thus taking up the slack in the vaginal walls, and with a long piece of chromic gut on curved needle in a long holder a good substantial "bite" is taken in the fascia at the bottom of the cul-de-sac between the freed peritoneum and the posterior vaginal wall and another "bite" is taken in the fundus of the uterus. When the suture is tightened the fundus of the uterus will be attached to the cul-de-sac fascia; the uterus thus



undergoing as it were a complete retroversion riding upon the connected round ligaments as its fulcrum. In doing this the vaginal walls are pulled up tightly because the uterus is here used as a lever against a strong and firm fulcrum (the connected round ligaments). The peritoneum is now sewed over the uterus to the peritoneum of the bladder as in hysterectomy. In extreme cases it may be necessary to do a supravaginal hysterectomy and use the stump of the cervix left to be drawn down into the cul-de-sac over the round ligaments, thus giving tighter vaginal walls. It is necessary that the round ligaments be fairly strong and firm and do not hang too low in the pelvic cavity.

I have performed this operation in several cases, and it has given in all of them most gratifying and satisfactory results.

## EDITORIALS

### SURGERY GYNCOLOGY AND OBSTETRICS

FRANK MARR, M.D. Managing Editor  
ALLAN D. K. VETTER, M.D. Associate Editor

WILLIAM J. MARR, M.D. Chief of Editorial Staff

APRIL, 1924

#### MEDICAL JOURNALS IN THE ENGLISH LANGUAGE

IN May 1923 the *Lancet* celebrated its centenary. It is a matter of just pride to the medical profession of the world that the *Lancet* has diffused medical knowledge to the English speaking public for four generations. Since the establishment of the journal by Thomas Wakley in 1823 its policies have been directed by a member of the Wakley family. The fearless policy of the *Lancet* has for a century aided the members of the regular medical profession in England in maintaining a high scientific position free from fads and quackeries.

In America the *Journal of the American Medical Association* is a source of pride and satisfaction to the medical profession. It can be said truthfully that this is the greatest medical journal in the world and that it supplies the largest organized body of medical men in the world with information on medical topics. The American Medical Association is inseparable from the *Journal* and the *Journal* in turn is inseparable from its editor Dr. George H. Simmons, who in his dissemination of so called graduate medical literature

has done more for the medical profession of the United States as a whole than any other man of his time.

Of the many other valuable medical journals of high character and wide scope including those devoted to special fields I shall allude only to four that are notable in surgery.

The *Annals of Surgery* was the first journal devoted to surgery published in America. From its early years it has been edited by a man who is not only a master of the English language but is also a surgeon of wide experience. We are thankful that Dr. Lewis G. Pilcher has had the strength to maintain the editorship which has given him so distinguished a place in surgical literature.

In the last few years the merit of two new surgical journals, each appealing to surgeons of the highest intelligence has gained recognition. The *British Journal of Surgery* issued quarterly under the editorship of a committee of which Sir Berkeley Moynihan is chairman maintain a high scientific standard this may be said also of the *Lectures of Surgery* edited by Dr. Dean Lewis and published by the American Medical Association for the purpose of advancing surgical science and stimulating research.

**SURGERY GYNCOLOGY AND OBSTETRICS**, the official organ of the American College of Surgeons, the wide distribution of which is evidence of its popularity and excellence is before you and speaks for itself.

Graduation from medical college is but the commencement of the practice of medicine. For a few men it is the end of a professional life and the beginning of a trade but the large majority of the members of the medical

profession are hard working, intelligent earnest men, anxious to give their patients the benefit of the latest scientific knowledge. In the process of the physician's education after graduation, clinical trips play an important part. These trips should be made for the purpose of investigating and studying the achievements of others. Time should not be consumed in the observation of inferior work. Attendance at medical meetings is helpful because opportunities are afforded for the exchange of views and for better understanding of the personalities of forceful men of the medical world who are contributing to progress.

Above all familiarity with the contents of medical journals is essential. Every practitioner of medicine should charge himself with the obligation of devoting at least an hour a day to their study and should pay the debt. If for any reason he misses a day or two he should make up the time but if on any one day he is able to read for a number of hours, he should credit himself with only the single hour. The man who will follow this course will almost unconsciously become well informed in medical matters and if he has the power to apply and correlate this knowledge with his own experience he will become a leading member of the medical profession. Many men, in speaking of an original conception of a disease, an original method of treatment, or an original operation have informed me that the idea came to them in the attempt to correlate their own experiences with those reported by writers of articles in medical journals.

To the physician patients represent medicine in practice, books on medicine represent stabilized medical opinion, and medical journals, the very breath he breathes, represent medicine in the making.

W. J. MAYO

## THE TEACHING OF UNDERGRADUATES IN MEDICINE

**D**URING the past 30 years we have witnessed great changes in the method of teaching undergraduates. In fact one might almost say it had been revolutionized. Sufficient time has now elapsed since the inauguration of these changes to estimate their value properly and those who should do this are those familiar with both the old and the new method. Perhaps it might be well in the beginning to grant that on the whole the present method is the better but in some particulars I think it is much inferior.

The object of the medical school has always been and should continue to be the turning out of men capable of giving to the sick the proper care and attention, in other words the making of doctors. This should be our prime object. If perchance we should occasionally turn out a scientist or an embryo discoverer so much the better but it is a fatal mistake to try to make all our students research workers in the hope that one or two of each class may ultimately turn out to be a real scientist. All should have a thorough general knowledge of the fundamental branches especially anatomy, physiology and pathology and then they should be taught diagnosis and treatment. None will probably take exception to this formula but an inspection or rather a questioning of recent graduates will show I think that it has hardly been adhered to in recent years. The men have been taught a few things very thoroughly or have studied one phase of a subject very diligently to the neglect of others equally necessary to the development of diagnostic ability and judgment. Let me illustrate taking first anatomy. There was a time when a good knowledge of general anatomy was considered essential when a student must have dissected every part of the human body but this time

has apparently passed in many schools. In the English, Scotch, and French schools, the medical student is much better instructed in this important subject than in ours, where too often special work in one department of anatomy such as embryology or histology or the careful dissection and study of one part is taken as a substitute for a general working knowledge of the whole subject. Many recent graduates have told me that they had dissected only an arm or leg others that they had never had any systematic instruction in general or topographical anatomy and still others, a few who said they had never seen their professor of anatomy and were supposed to gain their knowledge by reading and the contemplation of charts and dissected parts. Another very intelligent interne, finely trained along certain lines, told me he knew every thing about a Colles fracture but not a thing about any other that he had never seen any other nor had 5 minutes instruction on the general subject of fractures. Should such a man, however brilliant, be given the degree of doctor of medicine and allowed to practice? I think not and yet it is no fault of his own but that of his teachers. Many other recent graduates have no knowledge of the diagnosis of fractures or of the methods of reduction, for the one they depend entirely on the X rays, and for the other on open operation and commentary indeed on their medical education, but I assure you it is no exaggeration.

We are teaching undergraduates what we should teach graduates. This change is noticeable usually in the third year of the medical course and sometimes it begins to make its appearance even before this. The latter is noticeable when a first or second year student is allowed to neglect his systematic studies and is given credit for work not done in these lines because he is doing special laboratory work under the direction of a head, or sub-

head, of a department. This work may be developmental and of great value to the student in later life, but cannot and should not take the place of systematic and thorough study of the fundamentals. Sometimes this special work of the student is of no value to him whatever being simply the work that a *dilettante* might do requiring no exercise of the knowledge the student has already acquired. Too often it is simply playing a minor and, as far as the student is concerned, a useless part in a piece of pathological research the professor is doing.

These observations, I think, show that some of the changes which have taken place in recent years do not represent advancement, but the contrary. One cause of these changes is the tendency in recent years to appoint men to the chairs in undergraduate schools because of the reputation they have gained as research workers or in some limited field of medical or surgical practice, regardless of their ability and sometimes in spite of their inability to teach. The professor in an undergraduate school should first of all be a teacher. If per chance he should also be deeply interested and engaged in research so much the better but the inability or disinclination to impart to the students committed to his care the well established facts regarding the subject he is supposed to teach, while he and a few chosen students endeavor to discover new ones, should render him ineligible to a chair in an undergraduate school. It is no easy or agreeable occupation to go on year in, year out, teaching well known and established knowledge but this is just the duty which a professor owes to his school and his students. To the real scientist this should not be distasteful, for he must realize that his students cannot reach the point of being able to do advanced and valuable research without this fundamental knowledge, which he himself took many years

to acquire. We need real pedagogues in our medical schools and we can do with less research conducted by the student to the neglect of those fundamental studies which must form the basis of all valuable advanced work. I believe that many students who would ultimately do distinguished work in their profession, either as scientists or practitioners have their careers spoiled or at least handicapped by the lack of a thorough general knowledge of anatomy physiology chemistry and pathology. The medical schools have turned out too many men highly trained along certain limited lines who are grossly ignorant of the principles of medicine and surgery. And it is hard, pretty nearly impossible for those men to make up this loss and they go through their careers as narrow men instead of broad men. They are "hell on fits, but on fits only with the world full of other ills demanding study and attention.

The professor of anatomy who teaches only the phase of anatomy in which he is particularly interested is comparable to the surgeon who spends his time teaching the technique of difficult and often unusual operations when he should be drilling into his students surgical principles familiarizing them with the clinical picture of surgical diseases and endeavoring to develop in them, to some extent at least, surgical judgment. The first plan may be the pleasanter but it does not cancel the professor's obligation, and it turns out on the world a lot of impractical automatons. The hardest thing to teach in any branch of medicine is the reasoning which is so essential to the successful diagnosis and treatment of disease and yet this should be one of the prime objects of the teacher of undergraduates in medicine.

In our endeavor to do away with the old didactic method which certainly has its faults and substitute the bedside method of teach-

ing we must not lose sight of the fact that a large body of the class may fall entirely to receive instruction on important subjects. To teach only from the patients who happen to be in the wards or dispensaries is a great mistake and can never take the place of orderly systematic instruction. There cannot, however be too much teaching with the patient and student both at hand.

I hope in trying to make clear certain points I have not indulged in exaggeration and think I have not. If then you can agree with me you can readily see that unless we adhere to what is good in the old method and avoid what is bad in the new we are sure to fail in what would seem to be our *raison d'être* namely the turning out of doctors to treat the sick.

There are some however who will disagree with much if not all I have said and to them I should reply that it is our failure to turn out practical doctors and enough of them to take care of our communities that has been a potent factor in the propagation of osteopaths chiropractors and other quacks.

The medical schools of the United States must graduate physicians who can and will treat the sick not in the larger cities and medical centers only but in the villages and hamlets and in the far away places of the earth. The time is coming when the public will demand of the medical school a production in proportion to its endowment.

A French surgeon who recently visited the medical schools of America was surprised at the size and equipment of some of our schools but when he learned of the number of students being taught he was astounded and said "In France with such a plant and such an endowment we could teach thousands where you teach hundreds. An exaggeration, if you want, but food for thought.

JOHN H. GIBSON

# MASTER SURGEONS OF AMERICA

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GEORGE RYERSON FOWLER

**F**OR twenty five years previous to his lamented death in February 1906 George Ryerson Fowler held the foremost place among the surgeons of Brooklyn New York. In securing this place he had not been helped by any adventitious circumstance. It was the result of his own energy and capacity.

He was born in New York City December 25 1848 of parents who for several generations had transmitted the best traits of an English Colonial strain. Later his father having been made the master mechanic in charge of the repair shops of the Long Island Railroad, removed to Jamaica, Long Island, where the shops were located. Here the young George grew up and in the common school of the village was taught until he was old enough to enter as an apprentice the shop which his father superintended.

Meanwhile, the civil war broke out. George was fired with desire to have a part in it, and soon after its outbreak, being yet a boy of twelve years of age, ran away to seek a recruiting station in the City. A police alarm discovered him and he was brought back to his parents in the custody of a policeman and was persuaded to defer his military aspirations. He always retained a penchant for military affairs and in later years ran the whole gamut of the National Guard of his State from a regimental assistant surgeon to surgeon, brigade surgeon and surgeon general. The Spanish American War found him at the height of his professional activities, but he did not hesitate to throw everything aside and put on the uniform of his Country's Army. He was commissioned a chief surgeon of division and was assigned to duty as *medical inspector consulting surgeon, and chief of the operating staff of the Seventh Army Corps*, in which capacity he served throughout the war.

That the apprentice boy working at the bench in a railway repair shop should develop into a great surgeon was due—so Fowler himself used to say—to an accident in the shop when he was called on to assist in the care of the sufferers. The surgical instinct was then awakened in him. As it grew it was fostered and directed especially by two men who took an interest in him, one a pharmacist and the other a former army surgeon. The open, frank, and enthusiastic nature of the boy which enlisted the help of these men in realising his ambition caused him in after years, when he had boys of his own, to show his grateful appreciation



GEORGE RYERSON FOWLER  
1848-1906





of what these early friends did for him by bestowing upon these boys the names of these earlier friends! Doubtless this experience of the shop accident called forth the peculiar instinct of the young apprentice, but the soil must have been ready for the seed—Nature's gift of the qualities that manhood was to develop and ripen.

The path from the shop to the benches of the medical school was an easy one sixty years ago. Three years of study including two courses of lectures at a medical school sufficed to earn a degree. Of course then as now such a training could only have introduced a man into the vestibule of medical knowledge. It opened the door. It pointed the way the later progress depending upon the inherent qualities of the neophyte himself. Fowler made the most of his opportunities. He was thoroughly in earnest. He had a mind quick to apprehend, thirsty for knowledge, and a natural mechanical aptitude that turned him especially to those things in which the hand could actively engage to accomplish an end. He was a born surgeon, indefatigable in the dissecting room and devoted to the clinic. He did not attempt to secure an hospital Internship because he could not afford to put off for a year or more the beginning of the time when he could earn money to pay his debts as well as to secure his daily bread. In 1871 he was graduated as a Doctor in Medicine from the Bellevue Hospital Medical College and at once opened his office in Brooklyn in a location that promised an immediate demand for his services.

It was in the crowded tenements of the poor that he found the experience that took the place of hospital wards. For fifteen years thereafter he carried on a constantly enlarging general practice, in which however the surgical element became increasingly prominent. He had no hospital connection, no teaching position, no influential coterie of friends to push his fortunes. It was purely the force of his own personality that made his career possible. He began his work just as the Listerian teachings were coming to be appreciated by the surgical world. Fowler accepted the doctrines of antiseptics with enthusiasm and led in their advocacy despite the critical skepticism of the older surgeons who had hitherto controlled the surgical situation in the community. He wanted to teach, he wanted the opportunities of a hospital ward, he constantly felt the urge of the surgical spirit that was in him. The avenues to such positions in all the existing institutions were preempted by others. At last the opening of a new hospital brought to him the desired opportunity when, in 1883, he was appointed one of the surgeons to the recently opened St. Mary's Hospital. Four years later when the Sency Methodist Episcopal Hospital was opened he was appointed one of its two attending surgeons. Later when the staff of the Brooklyn Hospital was re-organized he was made its chief surgeon, and somewhat later still upon the organization of the German Hospital the first surgical appointment on its staff was given to him. By 1890 he was in the full tide of his surgical activities. Un

tiring, full of enthusiasm, delighting in his work, he was passing from hospital to hospital. He was not only an untiring worker but he was equally untiring as a student. He read he wrote, he traveled, he mingled with men, he steadily grew in mental breadth and in professional capacity while his natural aptitude and his manual skill remained the dominating elements in his special work. He was elected to membership in the New York and in the American surgical societies. He attended the International Medical Congresses at Moscow and at Paris. When in 1890 the State of New York instituted a State Board of Medical Examiners, he was appointed one of its organizers, and the chair of surgery was assigned to him a position which he continued to hold throughout the remainder of his life.

Fowler's contributions to surgical literature were frequent. Although he was continually doing an amount of work that would exhaust the endurance of a half dozen ordinary men he never seemed to be tired, and after a full day's work in office, ward, and operating room, would settle down to writing in his library until the early morning hours. When he did retire an emergency call that would rouse him from his bed would be responded to by him with the readiness and eagerness of a recent graduate. The number and variety of his papers on surgical subjects testify to his industry and to the scope of his labors. While his writings dealt with all regions of the body it is probable that his name will long be associated especially in thoracic surgery with the subject of the decortication of a lung in chronic empyema, and in abdominal surgery with the early operative treatment of appendicitis and with the semi-sitting position in the treatment of general peritonitis the "Fowler position."

Among the pioneer workers in appendicitis he was most earnest in advocating early and radical surgical interference. His work on the subject, published in 1894, will remain as a valuable landmark in the history of the evolution of the surgery of the appendix.

For many years he labored in the preparation of a systematic treatise on surgery to the writing of which he devoted hours that he stole from the tale of those that should have been devoted to sleep. It was published in 1906. The last proof sheets were corrected by his own hand but he did not live to see a printed copy of the book over which he had labored so assiduously through the years. In February 1906 while en route to attend a meeting of the State Medical Examining Board in Albany he was seized with intense abdominal pain on arrival he was carried to the hospital. His colleagues operated with all promptness for the removal of a gangrenous appendix he lingered for a few days a paresis of the ileum developed which was obstinate to all efforts for its relief and on the sixth day of February in the beginning of his fifty-sixth year his great heart stood still. In the completion of his book he had evidently completed his life's work. His book is the epitome of his life—into every page of it he infused his own personality. It

is valuable in itself. In its clearness of diction, comprehensiveness of treatment, and the practical directions for resort to surgical relief it is unsurpassed by any book of its day. It is still more valuable however as an example of the possibility of the achievements of ardor, enthusiasm, pluck, energy and perseverance in wresting brilliant success out of conditions apparently forbidding and sterile.

George R. Fowler was of medium height, compactly built, with a frank, attractive countenance, and a piercing eye. He was companionable and engaging in his relations with his fellows, always kindly and sympathetic in his attitude to those who sought his help. He had a breezy, positive way about him that could not fail to awaken the confidence of those with whom he came in contact. He always carried his profession with him and loved to talk about any phase of it. He left an enduring impression upon the community in which he lived as well as upon the surgery which he loved. In the work of his pupils and of his sons who now occupy positions of responsibility in the surgical world he still lives.

LEWIS S. PILCHER

# TRANSACTIONS OF SOCIETIES

## CHICAGO SURGICAL SOCIETY

REGULAR MEETING HELD NOVEMBER 2, 1923 DR. ALLEN B. KANAVEL, PRESIDENT

DR. CLARENCE W. HOPKINS read a paper entitled "I. Joints and Anomalies of the Spine."

### THE USE OF BOILED BEEF BONES AS INTRAMEDULLARY PEGS IN FRACTURES OF LONG BONES—AN EXPERIMENTAL STUDY

DR. CHARLES DAVIDSON AND DR. FREDERICK CHRISTOPHER contributed a joint paper on the use of boiled beef bones as intramedullary pegs in fractures of the long bones. (See page 534.)

#### DISCUSSION

DR. CHARLES DAVIDSON: Scattered throughout the literature are reports of cases of fractures treated by the boiled beef bone peg, but the end results, as a rule, are not given. This led us to try to follow up the end results in some cases, but we were unable to follow them long enough to learn what the end results would be. We undertook these experiments with open minds hoping to find something of value. I think many of the human cases reported were discharged while the beef bone pegs were intact and apparently a clinical cure obtained. From watching these dog experiments there is no question but what there is a period when an apparent cure of the fracture is present. The part of the beef bone peg which lies between the bone fragments, which is unprotected by periosteum or live bone, gradually absorbs until it spontaneously disintegrates or breaks through, allowing the fracture to become loose. Then it must go through a period of non-union, possibly with displacement and union in a malposition. Our experiments condemn the use of boiled beef bone as a means of treatment of fractures in the human.

DR. M. L. HARRIS: In the treatment of fractures of the long bones, foreign bodies of whatsoever material filling the medullary cavity as dowel pins or internal splints, are not desirable. Their introduction necessitates the destruction of a great deal of endosteum, which is of so much importance in the repair of these fractures. The detrimental effect of such foreign bodies on the healing of fractures has often been demonstrated experimentally.

DR. HARRY M. RICHTER: I am very much interested in the work done by Doctors Davidson and Christopher. However, my results are so absolutely different from those obtained in their experiments

on dogs that it seems to me the basis for this difference should be sought by workers in this field.

I have used beef bone and ox horn pegs as dowels in fractures in the human being with perfect clinical results. It seems to me that the bone peg functions as a fracture as does catgut in the suturing of fascia. Its purpose is to hold the ends of the bone in contact. It may have a second purpose, namely to hold the fragments in a straight line, but this is better attained by external supporting splints, the ends of the fragments being held in contact by the bone pegs. The function of the latter ceases when sufficient callus is formed to prevent slipping, provided the external splints are applied. It is rather desirable than otherwise that they should disappear early for having performed their function, their continuance in position must be as a foreign body and unless it is not harmful. In one of the X-ray plates shown by Dr. Christopher that part of the bone peg which projected from the fragment showed absorption while that part within the fragment threw

a darker shadow. My explanation of this phenomenon is quite different from that of Dr. Christopher. I would suggest that that part of the bone peg which projected into the soft tissues was absorbed as is all tissue within a foreign element, while that part buried in the fragment was impregnated by the live bone of its environment. And it seemed to me that this proves that the bone dowel does not inhibit medullary growth and does not account for the inhibition of callus formation in the experimental work. That it does not inhibit callus formation is also proven by my own clinical results and by the work of others whose results have been at variance with those of the speaker.

DR. WILLIAM R. CURRIE: To me it seems perfectly clear that Doctors Davidson and Christopher have demonstrated conclusively that there is no comparison between the use of live bone and dead bone in transplants. It is extremely interesting to see the great effort made by the young vital bone of the pup to grow into the boiled bone graft. In the older animals this does not occur.

I must take issue with Dr. Richter that the boiled beef bone graft serves as well for a splint as living bone. And especially must I take issue with him upon the statement that it is only necessary to immobilize these fragments a short period of time. In two of my patients in which an intramedullary splint

of autogenous living bone was made, one a humerus and the other a femur marked bowing occurred in the femur which was taken out of the cast 7 weeks following the implantation of the graft, a very marked lateral bowing occurred after that period in the humerus, marked bowing occurred upon the removal of the splint 3 weeks after the implantation of the graft. These conditions occurred in spite of the fact that the graft lived and has since demonstrated that it is living and taking up the functions of the bone into which it was implanted.

Why it should take longer in some instances for these bones to stick together with an intramedullary bone graft it is not possible for me to state but there does seem to be a slight inhibition in the production of firm callus in some of these cases. If that is true with living bone, it seems obvious to me that boiled beef bone could be far more likely to cause a serious disturbance, just as has been shown by Dr Christopher.

Dr C C ROGERS I would like to ask Dr Davison why when these bones were put together and dowels put in, there was no union. It seems to me, that in the proper preparation and the application of a cast, better results would be secured than if a bone peg were not used. Why is it that when put in apposition and a bone peg inserted these bones do not unite as they would if the bone peg were not put in?

Dr E C RIEBEL With reference to the fractures Dr Richter spoke of, I wish to say that Lexer has recently stated that there is a field for the use of bone pegs but this use is limited. He lays great stress on the fact that a reasonable time should elapse before operation for the development of a hyperemia, as there is a fight between specific and non-specific tissue elements. If the specific elements get the upper hand, we get union, but if the non-specific elements predominate, we get non-union. Hence we should await the optimum time during which the specific bone elements have their greatest reparative force. As Dr Richter stated, there is a certain time when these fragments will hold, that means, when the specific elements are in state of full development otherwise, connective or non-specific tissue elements will invade the bone be it beef or living bone.

Dr E WILLIS ANDREWS At the International Congress of Surgeons, held in London a year ago the work of MacAusland, of Boston, was largely along the line of arthroplastics and transplants. The proteolytic elements produce absorption of these fragments where the condyles or other bones are transplanted. There is one thing we must do and that is to type individual animals or humans almost as carefully as we would do in cases of transfusion. There is scarcely any doubt that today a couple of dogs can be transfused one with the other back and forth until we get them completely typed, and then we can make a successful transplant of whole tissues as well as fascia. If there is any feature in the successful preservation of these grafts in the living,

it is probably in the line of first preparing our patients, making them actual donors and recipients over quite a period of time.

Dr PHILLIP KRETSCHER During the 7 years of my association with Dr Murphy it was part of my duty to look after the bone and joint cases postoperatively. As far as I know only one beef bone was used as a medullary transplant all the others were autogenous transplants placed into the medullary canal. In ordinary cases of non-union it is necessary to immobilize absolutely for a period of three or four times that required for normal union. If there is bone defect which must be spanned, then, of course immobilization must be continued very much longer. I have under my care a case of fracture of the radius in which there was a defect of  $\frac{1}{4}$  inches. I did a medullary bone graft and have kept the arm immobilized for a period of 18 months. It is my belief that an intramedullary transplant in no way interferes with the normal healing nor that it is less efficient than the sliding graft. I have an X ray of the tibia in which an absolutely normal medulla is shown 18 months after an intramedullary transplant.

Success in these cases depends upon absolute asepsis, and second, complete immobilization not only as far as flexion deformity is concerned, but as regards torsion or twisting of the bone.

Dr CHARLES DAVISON (closing on his part). If you had seen these specimens as we took them out, there would be no question as to what we are talking about. It is not a question of live bone. Experiments with live bone show different results. If you put in a live bone transplant under the same conditions, you will find that it fastens into the medulla that in the space between the two ends of the host fragments the transplant increases in size and it gets larger as time goes on. That is incidental. I am not arguing for live bone.

When that part of the beef bone which was encased in the medulla and covered by the endosteum became fixed and as fast as the beef bone was absorbed, its place was taken by new bone formed by the endosteum, so that part of the beef bone was kept solid at both ends in both fragments, but in that part of beef bone which was exposed between the fragments, not covered by live bone, and not protected by endosteum, there was the same or greater absorption, and there was no replacement by live bone from the host. These specimens show that whatever internal callus formation was produced, it did not bridge the defect.

There was gradual disintegration of the beef bone support, and nothing was produced to take its place consequently a late non-union of the fracture occurred. I believe that if many of the human cases reported as successfully treated could have been followed until absorption of the beef bone took place, a period of non-union would have been found.

Dr DANIEL N. EISENBRATH read a paper entitled "Urography as an aid to Abdominal Diagnosis," which will appear in later issue.

# THE SURGEON'S LIBRARY

## OLD MASTERPIECES IN SURGERY

By ALFRED J. BROWN M.D. F.A.C.S. OMAHA, NEBRASKA

### A ROSEGARDEN FOR PREGNANT WOMEN AND MIDWIVES

THE practice and knowledge of obstetrics was one of the most neglected fields of medicine during the middle ages. So-called obstetrics consisted in neglect of normal cases and butchery of abnormal. It was considered beneath the dignity of the physician to care for an obstetrical case even as a consultant and the sense of false modesty of the times precluded his active participation in the delivery. Consequently the management of the patient was left in the hands of ignorant and untrained midwives, and the physician was called in only to deliver hopeless cases and this was done usually by mutilation of both mother and child. Knowledge of the anatomy of the female generative organs was very meager as shown by the anatomical fugitive sheets of about 30 years later. The anatomy of the fetus and fetal membranes as handed down through the works of Hippocrates, Galen, Rhasis, and Avicenna and the illustrations in the various codices which followed the Soranus-Moschior form of the uterus and fetus which were far from correct, though they show that the various positions of the fetus as ~~was~~ were known clinically.

The time was propitious for the study of obstetrics clinically and an attempt to do something to decrease the mortality of women during childbirth. This opportunity was grasped by Eucharius Rosslin, the elder, a physician of Worms-on-the-Rhine and Frankfort-on-the-Main (died 1560 also called Rhodion). In 1513 he published his book, which he called *Der Schwangeren Frauen und Hebammen Ratgeber*. A Rosegarden for Pregnant Women and Midwives, which was the outstanding authority on obstetrics for over a century and was republished, somewhat altered at times went on, in various languages. Its best known form is as "The Birth of Mankynde" by Thomas Raynalde, 1535.

The name of Rosslin's book has been an enigma and several explanations for it have been offered. One has said that it was used as a play upon his name Rosslin or Rosslin, which means a little rose. Another said that it was so called because of the beautiful Rose Garden of Worms, his native city. The 1513 edition, printed in German, is a very rare volume and hence little known. In it Rosslin has written a portion of his preface in poetry and in the poem gives his reason for the name. He likens his words of advice to roses which bring brightness and

joy to those who heed them, and inasmuch as he has brought them together in a book, he says that he has made a garden and so he calls his little book the Rosegarden.

The book itself is simple and rather short compared to the subject of obstetrics. Throughout, it can be seen that he is writing for the information of midwives who apparently do all the manipulation of the actual delivery and the physician is only the consultant. It explains the usual position of the fetus ~~in utero~~ and describes the fetal membranes, which he says are three in number. The fetus is described in the see, speak, and hear ~~no~~ and position as the normal. It divides births into natural and unnatural according to the position of the fetus, and considers the breech presentation as the most simple of the unnatural births. Later, under the management of labor he gives detailed directions for the delivery of breech and foot presentations, and describes podalic version, which was later popularized by Paré. He likewise describes cephalic version, which he prefers. It advises sitting until the membranes bulge. Idly before puncturing them and gives early rupture of the membranes as one of the eighteen reasons for a difficult birth. For easy delivery he places great value on lubrication of the birth canal with various oils and salves used both externally and internally. He believes in careful preparation of the mother for delivery as an important factor in an easy birth. The directions for exercise, diet, and care of the bowels are clearly laid down in detail. Throughout the entire book the desire to make the burden of the parturient woman light and as easily borne as possible can be seen. As later, Oliver Wendell Holmes and Semmelweis blazed the way for the avoidance of puerperal sepsis so Rosslin made the plea for care of labor and not neglect. The belief that the fetus breathed through the vagina is shown by the directions for looking the mouth of the uterus open should the mother die until a cesarean section, which he advises under such a contingency can be performed. His method of stimulating pains is rather heroic as he advises making the mother smell powdered hellebore or ground pepper to cause sneezing and so increase the abdominal contractions.

The final chapter of the book is divided into thirty-six parts, each of which treats of a different disease of the newborn child. So this portion of the work may be said to be the first special work on pediatrics.







## REVIEWS OF NEW BOOKS IN SURGERY

**T**HIS exhaustive historical, pathological and clinical review is based on 3,000 cases of tuberculous cases observed in the Rizzoli Institute of Bologna, Italy. The author divides his monograph into two parts: (a) general, in which he reviews the site of origin of bone abscesses, their contents, the mechanism of abscess migration and the development of the abscess itself, and (b) special, in which he discusses abscesses of the vertebral column, of the pelvis, of the hip, knee, and shoulder joints. His conclusions are: (1) While abscesses migrate along well-determined anatomical paths, purulent tuberculous collections do not always follow such paths. (2) Generally speaking, abscesses follow muscle-sheaths and those interstitial spaces which offer the least resistance to the mechanical and biochemical action of pus. (3) Neither muscles nor aponeuroses represent insurmountable barriers to pus invasion. Atypical points of escape may form in any part of the body. (4) Pus only very rarely travels along blood vessel or nerve sheaths. (5) Tuberculous pus very rarely produces vascular or nerve lesions. (6) Gravity and the ulcerative action of the tuberculous granuloma, and pressure of the abscess are the prime factors which regulate the migration of purulent collections. It is impossible to estimate which of these three factors plays the dominant rôle.

TAKAO SEKI

**T**HE object of this book is to bring to the general surgeon and specialist alike the detailed results of the author's vast and ripe experience in cleft lip and palate work with the end in view that better operative results may be obtained in these distressing deformities.

Dr Brophy may without flattery be called the greatest authority on all operations for cleft lip and palate. His experience in labio-palatal surgery has extended over a period of 4 years and up to 1930 has included over 5000 cleft palate operations. His development of the operative procedures in this field from the former crude methods to the perfection of the present technique, has made him famous and honored everywhere.

The bases for this book were the chapters on Cleft Lip and Palate in the author's book on *Oral Surgery* published in 1915. The subject has been gone into in far greater detail, and the results of more recent investigations and inventions, with many improvements in technique, have been added. The most important of these is the technique which prevents the spreading of the arch and retains the tuberosity of the maxilla in a normal position. Great emphasis is placed on the importance of retaining the premaxillary bones in a double cleft, no matter what their position, and the excision of these bones is denounced in no uncertain terms.

LEVIN B. BROPHY, M.D., M.A.C.S., DENT. SCHOOLS  
VINCENNES, INDIANA, U.S.A. 1931

CLEFT LIP AND PALATE, by Thomas W. Brophy, M.D., F.A.C.S.  
Philadelphia: W. B. Saunders Company, Inc. 1933.

The author stresses the fact that in the child a cleft palate is not the result of congenital deficiency of the parts nor arrested growth, but that with rare exceptions the normal amount of tissue is present at birth but is misplaced. This has been verified by a theories and must be accepted.

The technique of operation is described in great detail and here one will not fail to note the master mind and hand. There is also a complete description of the special instruments used with a cut of each one.

The subjects Medical Care in Cleft Lip and Palate Patients, Infant Feeding, and Training of Speech after Cleft Palate Operations are fully covered.

The book contains 446 illustrations and colored plates, mostly original, and those showing the author's technique are especially clear and bring out many of the fine details. An exhaustive bibliography consisting of nineteen pages in fine type is given and will be very useful to those especially interested in this subject.

In years past there have been many militant critics of the Brophy technique, but since mastering more completely all the essentials these men have almost invariably become very enthusiastic exponents of the ideas set forth by the author.

EARL THOMAS.

**T**HIS publication consists of a series of monographs, nine of which have been received for review. Forty one have already appeared, others are listed as contemplated or in preparation. Four monographs are devoted to general diagnosis and therapy; these are concerned with the application of experimental pharmacological investigation to pharmacotherapeutics, with immunology, dietetic treatment, orthopedics, balneo- and climatotherapy, psychotherapy, general diagnosis, roentgen diagnosis, and irradiation. The specialties considered in regard to diagnostic and therapeutic errors and their avoidance are internal medicine, represented by 16 monographs; surgery by 12; gynecology by 3; obstetrics by 4; ophthalmology by 4; otology by 3; skin and venereal diseases by 2; and pediatrics by 6 volumes.

Among the contributors to subjects of internal medicine are Professors Hoffman, Meyer Naegeli, Ebermayer v. Kocinyi, v. Noorden, Schlesinger, Krause, and Eppinger. The surgical monographs are by Dr. Chiari and Professors Clairmont, Haberer, Koerte, Ledderhose, Mueller Payr, Leusden, Sonntag, Tilmann and Voelcker. Gynecology is represented by Professors Henkel, Reifferscheidt, and v. Jaschke, and obstetrics by Professors Fehling, Zangemeister and Esch.

INSTRUMENTS FOR ALL SURGERY WITH SPECIALIZED DIAGNOSTIC AND  
THERAPEUTIC PURPOSES. V. KOCINYI. Edited by Prof. Dr. J. Schlesinger.  
Leipzig: Georg Thieme, 1933.

The monographs received vary in length from 77 to 329 pages. The quality of paper and the printing leave nothing to be desired. Each volume has complete index. The various treatises are well planned. They deal in an authoritative manner with diagnosis, differential diagnosis and treatment. The style is simple, clear and concise; the discussions are comprehensive and include the more recent aids in diagnosis and treatment. Pitfalls in diagnosis are pointed out and their means of avoidance indicated by careful differential diagnosis of conditions likely to be confused. The limitations, as well as the principles and details of treatment, are emphasized. In short, these monographs impress the reviewer as exceptionally valuable expositions of our present knowledge in regard to diagnosis and treatment. One wishes that they were available in English translation.

W. H. RADLKE.

THIS volume, with three hundred and thirty-five excellent illustrations, which is intended especially for undergraduates, more nearly meets their requirements than any other textbook in common use. In most books for students, too much space is given to operative details and different methods of performing major operations. In consequence, the text is too long and too elaborate for him to grasp the important parts pertaining to his fundamental preparation.

The recognition of diseases of the jaw and mouth and their bearing upon general disease, their differentiation and symptomatology is far more important, not only to the student but to the general practitioner of medicine and dentistry as well.

ESSENTIALS OF ORAL SURGERY. By V. W. PETER, DENT. M.D., F.A.C.S., and Robert Henry Ivy, M.D., D.D., F.C.S. St. Louis: C. V. Mosby & Co.

After a concise review of the "Anatomy" and "Study and Diagnosis of Diseases," Infection, Inflammation and Its Sequelae are treated in lucid manner which facilitates teaching of these fundamentals.

Accompanying the text are pertinent illustrations which materially aid the student in fixing the subject matter in his mind, helping him to grasp the disease as an entity rather than confusing him by detailed descriptions of less relevant signs and symptoms.

This book will be of value to physicians and dentists as a reference work on diagnosis of lesions of the mouth and jaws, as well as a guide to the oral surgeon.

H. A. FORT.

*RUBBER and Gutta Percha Injections* contains the report of the author's studies and experiments with subcutaneous injections of rubber and gutta percha for the correction of depressions of the nasal bridge and of other external contours, especially of the face.

On account of the inconstant degree of purity he finds it necessary to try out each fresh supply and gives his method of so doing. In particular, he warns operators against infection and the deposition of these foreign bodies within the layers of the skin. He admonishes the operator to tell his patients that these operations are, as yet, not recognized as established surgical procedures.

The book should be helpful to anyone pursuing a similar line of study.

H. A. FORT.

REPAIRS TO GUTTA PERCHA INJECTIONS: Subcutaneous Injection of Rubber and Gutta Percha for Raising the Depressed Nasal Bridge and Altering External Contours. By Charles Conrad Miller, M.D. Chicago: Oak Publishing & Publishing Co. 1912.

## BOOKS RECEIVED

Books received are acknowledged in this department and such acknowledgment must be regarded as sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

**INTERNATIONAL CLINIC** Vol. Edited by Henry W. Catlett, A.M., M.D. Philadelphia and London J. P. Lippincott Company 1923.

**THE TOLERANCE OF ACUTE INTESTINAL OBSTRUCTION OR VOMITING AS PATHOLOGICAL FORCE** By R. H. Paterson, M.D. (London) F.R.C.S. (Eng.) London H. K. Lewis & Co. Ltd. 1923.

**A SYSTEM OF SURGERY** Vols. 1, 2, and 3. Edited by C. C. Choyce, C.M.G. C.B.E. B.Sc., M.D., F.R.C.S. Pathological Editor J. Martin Beattie, M.A. M.D. C.M. New York Paul B. Hoeber, 1923.

**LOCAL ANESTHESIA** Its Scientific Basis and Practical Use. 2d American from the 6th rev. German edition. By Prof. Dr. Heinrich Braun. Translated and edited by Malcolm L. Harris, M.D. Philadelphia and New York Lea & Febiger 1924.

**ANNUAL REPORT OF THE SURGEON GENERAL OF THE PUBLIC HEALTH SERVICE OF THE UNITED STATES** For the Fiscal Year 1923. Washington Government Printing Office, 1923.

**OPERATIVE SURGERY** Covering the Operative Technique Involved in the Operations of General and Special Surgery. Vols. and By Warren Stone Brinkman, M.D. and Ph.D. M.D. F.A.C.S. Philadelphia and London W. B. Saunders Company, 1924.

**CLINICAL LABORATORY METHODS** By Russell Landrum Hader, M.A. M.D. St. Louis C. V. Mosby Company.

**MANAGEMENT OF THE SICK INFANT** 2d rev. ed. By Langley Porter, B.S. M.D. M.R.C.S. (Eng.) L.R.C.P. (Lond.) and William E. Carter M.D. St. Louis C. V. Mosby Company 1924.

**PRACTICAL CLINICAL ANALYSIS OF BLOOD** 2d rev. ed. By Victor Caryl Meyers, M.A. Ph.D. St. Louis C. V. Mosby Company 1924.

**SELECTED ESSAYS ON ORTHOPAEDIC SURGERY** By Newton Meigs Shaffer, M.D. F.A.C.S. New York and London G. P. Putnam's Sons, 1923.

**HEALTHY BABIES, HEALTHY CHILDREN, AND HEALTHY MOTHERS** in obs. By S. Josephine Baker M.D. D.P.H. Boston Little, Brown and Company, 1923.

**DOEDERLEIN'S KLINISCHE OPERATIVE GYNAEKOLOGIE** 5th ed. By Dr. med. et Dr. art. obs. h. Albert Doederlein Leipzig Georg Thieme, 1924.

**DIE DARMSCHLEIMHÄUTE UND DIE SONSTIGEN WEICHTEILE DES DARMS** By Prof. Dr. W. Braun and Dr. W. Wittenberg Berlin Julius Springer, 1924.

**MODERN UROLOGY** In Original Contributions by American Authors. Vols. and 2d ed. revised. Edited by

Hugh Cabot, M.D., C.M.G. F.A.C.S. Philadelphia and New York Lea & Febiger, 1924.

**SURGICAL PATHOLOGY** By Joseph McFarland, M.D. Sc.D. Philadelphia P. H. Kistner's Son & Company 1924.

**EIGHTH SCIENTIFIC REPORT OF THE INVESTIGATIONS OF THE IMPERIAL CANCER RESEARCH FUND** London, T. Yorke and Francis, 1923.

**EMERGENCY OPERATIONS FOR GENERAL PRACTITIONERS ON LAND AND SEA** By H. C. Otter, O.B.E., F.R.C.S. (Edin.) New York William Wood & Company 1924.

**LECTURES ON ENDOCRINOLOGY** By Walter Thimms, M.D. New York Paul B. Hoeber Inc. 1924.

**LA TENSION ARTERIAL Y VISCERIDAD SANGUÍNEA EN EL ESTADO FISIOLÓGICO** By Dr. Francisco A. Delgado. Buenos Aires Imprenta Mercatal, 1923.

**AN INTRODUCTION TO SURGICAL UROLOGY** By William Knox Irwin, M.D. (Aberd.) F.R.C.S. (Edin.) New York William Wood & Company, 1924.

**BIOLOGIE UND P. BIOLOGIE DES WEIBES** Ein Handbuch der Frauenheilkunde und Geburtshilfe. Edited by Josef Halban, Wien, and Ludwig Seitz, Frankfurt a. M. 4—

**Normale Entwicklungsgeschichte der weiblichen Geschlechtsorgane des Menschen**, by Prof. Dr. W. Lubowich, Wernberg. Anatomie, Histologie und Topographie des weiblichen Urogenitalapparates by Prof. Dr. O. Oertel, Koenig, Vergleichende Anatomie der weiblichen Geschlechtsorgane der Hausvögel (Hühner, Fische, etc.) by Prof. Dr. R. Schmalz, Berlin, Rassenlehre by Prof. Dr. C. H. Strauß, Haag. Physiologie der weiblichen Genitalorgane, by Prof. Dr. L. Frankel, Breslau. Berlin Urban & Schwarzenberg, 1923.

**INTRAMASAL SCLEROSIS** By Fred J. Pratt, M.D. F.A.C.S. and John A. Pratt, M.D. F.A.C.S. Philadelphia F. A. Davis Company 1924.

**PRACTICAL ELECTROTHERAPEUTICS AND DIATHERMY** By O. Bolton Massey M.D. New York The MacMillan Company 1924.

**OBSTETRICAL NURSING** A Manual for Nurses and Students and Practitioners of Medicine 2d ed. rev. By Charles Sumner Bacon, Ph.D. M.D. Philadelphia and New York Lea & Febiger 1924.

**A PHYSICIAN'S MANUAL OF VACCINE THERAPY** By G. H. Sherman, M.D. Detroit From the Bacteriological Laboratories of G. H. Sherman, M.D.

**DIE ROSENZUGERHEIMKUR UND DIE UTERUSKUR** By Dr. med. et Phil. Hermann Wints Leipzig Georg Thieme 1924.

**THE CULTURE OF THE ANDROSA** By J. A. Hordbrook Prefaces by Sir William Arbuthnot Lane (Bart.) C. B. M.S. London William Heinemann, Ltd. 1924.

**PAPERS AND ADDRESSES IN SURGERY** By R. Hamilton Russell F.R.C.S. (Eng.) Melbourne Allan Grant, 1923.

**DIE KLINISCHE OPERATIONS-TECHNIKE** Der Schule Ernst Wertheims. Edited by Professor Dr. Wilhelm Weibel Berlin Julius Springer 1923.

## CORRESPONDENCE

### BLUISH DISCOLORATION OF UMBILICUS IN CONDITION OTHER THAN RUPTURED ECTOPIC GESTATION

*To the Editor:* Bluish discoloration about the umbilicus has been described by Cullen<sup>1</sup> and Novak<sup>2</sup> in recent articles and it is claimed that this sign is pathognomonic of free blood in the peritoneal cavity accompanied by ruptured ectopic pregnancy. I have observed this sign to be true in several cases but not always constant. Lately it was noted to be present in a lesion quite the contrary.

Patient, age 25, married a 4 nulliparous complained of a pain in the left lower abdomen, which had not been present except the last 15 days. The history is unessential except patient has always enjoyed good health. There have been no abnormalities about menstruation and patient has never been pregnant. She missed the last period and at time of examination was 10 days beyond the appearance time. She has had no vaginal bleeding. Patient is a well nourished woman, and examination is negative except for lower abdomen and pelvic organs. Abdomen is symmetrical and no muscle spasm is present. *A greenish blue discoloration is noted about umbilicus. It is circumscribed and about 3 centimeters in diameter. The color is most intense in the center and fades at the periphery. No free abdominal*

fluid is present but abdomen is sensitive to palpation in region of left tube and ovary. There is an oblong mass, fixed, smooth, firm, and about the size of a hen's egg is found. The external genitalia are normal and no bloody discharge is present. The cervix is soft, patulous, and freely movable. The uterus is slightly enlarged and the right tube and ovary are normal. The mass on left side which was noted on abdominal examination, is confirmed.

On opening the abdomen no free fluid was present. The uterus was found to be about the size of a 6 weeks' pregnancy. The tubes and right ovary were normal, but there was a cyst of the left ovary about 6 centimeters by 4 centimeters, which was adherent to the broad ligament. The left tube and cystic ovary were removed. Diagnosis was normal pregnancy and left ovarian cyst.

A report of one case is not very satisfactory but it does show conclusively that the sign is not pathognomonic for the lesion mentioned. It is hoped that this presentation will stimulate the interest to look for other abdominal lesions in which it could easily be present and from which some definite conclusions as to its cause may be made.

Burt Gyron & Otol.  
J. Am. Med. Ass.

LEWIS CLARK WAGNER, M.D.  
65 Park Avenue, New York

### MYOMATOUS UTERUS WITH RUPTURED TUBAL PREGNANCY AND EMBRYONIC DOUBLE MALFORMATION

*To the Editor:* I am reporting this case as of interest in connection with the article of Arey on tubal twins published in SURGICAL GYNECOLOGY AND OBSTETRICS, 1933, XLVIII, 407. I cannot furnish any clinical data as the protocols have been lost, so I have to restrict myself to the simple facts which are taken from the rich anatomical collection of the Queen Helena Civic Hospital of Trieste, the superintendent of which, Dr. Ferrari, I wish to thank very heartily for his kindness in placing the material at my disposal.

Many years ago a young anemic woman was brought to the hospital and died immediately after admission. Autopsy showed the cause of death to be an internal hemorrhage which had originated from a ruptured pregnant tube. Examination of the genitalia rendered the following very interesting findings (Fig. 1). The uterus was about 1 centi-

meters long and about 3 centimeters thick and showed a myoma nodule larger than a nut, situated in the neighborhood of the internal os uteri. The mucous membrane of the uterine cavity showed immense proliferation and allowed structure on the right side. The right ovary was of normal size and shape while the tube, which was the size of a goose egg in its ampullar part, showed in front a gaping, irregular tear 7 centimeters in length through which chorionic villi might be distinctly seen covering the entire internal wall. From there originated the umbilical cord, 2 centimeters long, which communicated with the abdominal cavity of the free-living fetus. The fetus was 9 centimeters long and consisted of a trunk with two independent heads which were connected with the trunk by one neck each. On the left and the right side of the trunk, one upper and one lower extremity had developed on



each. The case thus concerns a dicephalus dianthens dibrachius dipus. The left dxena do not show any deformities.

As far as I am acquainted with the literature, there is no other record of ectopically developed

fetus except the case reported by Kirchhoff (Ein Thoracopagus im tubaren Fruchtsacke Zentralbl f Gynaek 1894, N 10) which was also mentioned by Aray.

Torino, Italy

PROF. DOTT. PIETRO GALLI

## ABDOMINOSCOPY

To the Editor: In the February 9, 1904, issue of SURGERY, GYNECOLOGY AND OBSTETRICS I discussed abdominoscopy and referred to it as a new method. This was my true belief as I could find in the literature at my disposition no record of such method of examination. Since my article appeared it has been brought to my attention that the procedure had previously been described. In view of the earlier work I forfeit the claim of priority.

I have been informed that this method was de-

scribed by Kelling in 90 (Muenchen med Wchnschr 1900 N 10 p 10) and by Jacobaeus in 1910 (Muenchen med Wchnschr 1910 N 40 p 2090, also by Orndoff (J Radiol) 1920 M 7. The method has also been practically applied. I regret that at this time this literature is not accessible, therefore for details of their work I have to refer those interested to these papers.

Otto P. Steiner, M.D.

Atlanta, Georgia

# AMERICAN COLLEGE OF SURGEONS

## STATE MEETINGS OF THE CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

ILLINOIS, MISSOURI AND KANSAS TEXAS, OKLAHOMA, AND NEW MEXICO MISSISSIPPI, LOUISIANA, AND ARKANSAS KENTUCKY AND TENNESSEE GEORGIA ALABAMA, AND FLORIDA NORTH AND SOUTH CAROLINA AND NEBRASKA

### ILLINOIS MISSOURI, AND KANSAS

THE first sectional meeting of the Clinical Congress of American College of Surgeons for 1924 was held at the Statler Hotel, St. Louis, on January 18 and 19. This meeting was for the states of Illinois, Missouri, and Kansas.

The visiting speakers on the program were Dr. A. J. Ochener, Chicago; Dr. Charles H. Mayo, Rochester, Minnesota; Dr. James T. Case, Battle Creek, Michigan; Rev. C. B. Moulner, S. J., Milwaukee; Dr. Allan Craig, Chicago; Dr. M. T. MacEachern, Chicago.

The arrangements were in the hands of a local committee, with Dr. Paul Y. Tupper as chairman, and Dr. Fred W. Bailey as secretary. All the meetings were well attended and the clinics were interesting and instructive.

Executive Committees for the three states for the coming year were elected as follows:

#### Missouri

Chairman—Dr. Herman E. Pearce, Kansas City  
Secretary—Dr. William A. Sletten, Kansas City  
Counselor—Dr. Robert L. Neff, Joplin

#### Illinois

Chairman—Dr. Carl E. Black, Jacksonville  
Secretary—Dr. O. L. Polton, J. Elgin  
Counselor—Dr. E. B. Montgomery, Quincy

#### Kansas

Chairman—Dr. H. L. Snyder, Winfield  
Secretary—Dr. W. M. Niles, Topeka  
Counselor—Dr. J. L. Egan, Wichita

### TEXAS, OKLAHOMA, AND NEW MEXICO

The sectional meeting for Texas, Oklahoma, and New Mexico of the Clinical Congress of American College of Surgeons convened at the Texas Hotel, Fort Worth, January 22 and 23.

The visiting speakers on the program were Dr. James T. Case, Battle Creek, Michigan; Dr. W. C. MacCarty, Rochester, Minnesota; Dr. M. T. MacEachern, Chicago; Rev. C. B. Moulner,

S. J., Milwaukee; Mr. Robert Jolly, Houston; Dr. Allan Craig, Chicago.

Dr. Bacon Saunders of Fort Worth was chairman of the Texas State Committee. There was an excellent attendance of Fellows of the College. Executive Committees for the states of Texas and Oklahoma for the coming year were elected as follows:

#### Texas

Chairman—Dr. Bacon Saunders, Fort Worth  
Secretary—Dr. Everett Jones, Wichita Falls  
Counselor—Dr. W. E. Kinn, San Antonio

#### Oklahoma

Chairman—Dr. LeRoy Long, Oklahoma City  
Secretary—Dr. F. L. Carson, Shawnee  
Counselor—Dr. Thomas W. Aderhold, El Reno

### MISSISSIPPI, LOUISIANA, AND ARKANSAS

The sectional meeting for Mississippi, Louisiana, and Arkansas was held at the Edwards Hotel, Jackson, Mississippi, January 25 and 26.

The visiting speakers on the program were Dr. James T. Case, Battle Creek, Michigan; Dr. W. C. MacCarty, Rochester, Minnesota; Dr. M. T. MacEachern, Chicago; Mr. Robert Jolly, Houston; Dr. Allan Craig, Chicago.

Dr. John W. Barksdale, chairman of the State Committee, presided at the meetings. The arrangements were excellently carried out by the local committee and all meetings were well attended.

Executive Committees for 1924 were elected as follows:

#### Mississippi

Chairman—Dr. W. W. Crawford, Hattiesburg  
Secretary—Dr. J. P. Wall, Jackson  
Counselor—Dr. W. L. Britt, Jackson

#### Arkansas

Chairman—Dr. J. S. Jenkins, Pine Bluff  
Secretary—Dr. A. E. Chase, Texarkana  
Counselor—Dr. W. F. Smith, Little Rock

## Louisiana

Chairman—Dr J C White, Shreveport  
 Secretary—Dr C G Cole, New Orleans  
 Counselor—Dr L B Crawford, Patterson

## KENTUCKY AND TENNESSEE

The Kentucky and Tennessee section of the Clinical Congress of American College of Surgeons met at the Hermitage Hotel Nashville, January 28 and 29

Dr George R. West, of Chattanooga, chairman of the Tennessee Executive Committee, presided at the meetings.

The visiting speakers on the program were Dr James T Case, Battle Creek Michigan Dr Frank C. Mann Rochester Minnesota Mr Robert Jolly Houston Dr M T MacEachern Chicago Dr Allan Craig, Chicago

The arrangements were in the hands of a local committee with Dr Robert Caldwell as chairman and Dr A L Sharber as Secretary

Executive Committees for the coming year were elected as follows

## Tennessee

Chairman—Dr Battle Malone, Memphis  
 Secretary—Dr Viktor D Hallows, Knoxville  
 Counselor—Dr Perry Bromberg, Nashville

## Kentucky

Chairman—Dr Irvin Abell, Louisville  
 Secretary—Dr Elmer L Henderson, Louisville  
 Counselor—Dr David L Roberts, Louisville

## GEORGIA, ALABAMA, AND FLORIDA

The Georgia, Alabama, and Florida sectional meeting of the Clinical Congress of American College of Surgeons met at the Georgian Terrace Hotel Atlanta, January 31 and February 1

Dr William S Goldsmith, chairman of the Georgia Executive Committee, presided at the meetings

The visiting speakers on the program were Dr James T Case, Battle Creek, Michigan Dr F C. Mann, Rochester Minnesota Mr Robert Jolly Houston, Texas Dr M T MacEachern, Chicago Dr Allan Craig, Chicago Dr J R B Branch, Changsha, China

The clinical and hospital meetings were held at the Academy of Medicine. All were well attended

Executive Committees for the various states were elected for the coming year as follows

## Georgia

Chairman—Dr E G Belfrage, Atlanta  
 Secretary—Dr G P Hegarty, Atlanta  
 Counselor—Dr W P Harben, Rome

## Florida

Chairman—Dr John S Helms, Tampa  
 Secretary—Dr F J Wans, Jacksonville  
 Counselor—Dr J E Boyd, Jacksonville

## Alabama

Chairman—Dr E P Hogan, Birmingham  
 Secretary—Dr John O Rosh, Mobile  
 Counselor—Dr Samuel Kirkpatrick, Selma

## NORTH AND SOUTH CAROLINA

The North and South Carolina section of the American College of Surgeons was held at the Robert E. Lee Hotel, Winston-Salem, February 4 and 5

The visiting speakers were Surgeon General Merritt W Ireland, Washington, D C., Dr James T Case, Battle Creek, Michigan Dr J R B Branch, Changsha, China Dr M T MacEachern, Chicago Dr Allan Craig, Chicago

The local committee of arrangements provided excellent facilities for all the meetings and there was a good attendance.

The State Committees for the coming year were elected as follows

## North Carolina

Chairman—Dr John T Burns, High Point  
 Secretary—Dr John Wesley Long, Greensboro  
 Counselor—Dr Charles M Strong, Charlotte

## South Carolina

Chairman—Dr Robert S Cathcart, Charleston  
 Secretary—Dr D L Magnius, Charleston  
 Counselor—Dr Samuel O Black, Spartanburg

## NEBRASKA

The Sectional Meeting of the American College of Surgeons for the state of Nebraska was held at the Fontenelle Hotel, Omaha, February 18 and 19

The visiting speakers on the program were Dr A J Ochsmier, Chicago Dr James T Case, Battle Creek, Michigan, Dr Emil Beck, Chicago Dr Carl Hedblom, Rochester Minnesota Rev C B Moultrie, S J Milwaukee Dr M T MacEachern, Chicago Dr Allan Craig, Chicago

All the arrangements were in the hands of the local state committee with Dr A F Jonas, of Omaha, as chairman Dr Jonas presided at all the meetings

The Nebraska State Committee for 1924 was elected as follows

Chairman—Dr A F Jonas, Omaha  
 Secretary—Dr William L Shearer, Omaha  
 Counselor—Dr J Stanley Welch, Lincoln



## 1924 CLINICAL CONGRESS IN NEW YORK AND BROOKLYN

THE fourteenth annual session of the Clinical Congress of the American College of Surgeons will be held in New York and Brooklyn beginning on Monday October 20, and ending on Friday October 24, 1924. General headquarters will be at the Waldorf Astoria Hotel.

Local executive committees in charge of arrangements for the meeting have been appointed as follows

## NEW YORK

Eugene H. Pool, Chairman

John A. Vistor, Secretary

Cornelius G. Coakley	Charles H. Peck
William A. Downes	Robert G. Reese
Arthur B. Ducl	J. Bentley Squier
Benjamin P. Farrell	William E. Strudisford
Alfred T. Osgood	George Gray Ward, Jr.

## BROOKLYN

John E. Jennings, Chairman

Thomas M. Brennan, Secretary

Warren L. Duffield	Frank D. Jennings
Edwin H. Fiske	William Linder
Russell S. Fowler	Ralph I. Lloyd
Emil Goetsch	John O. Polak
Charles A. Gordon	Nathaniel P. Rathbun
O. Paul Humpstone	Jacques C. Rushmore
	Charles E. Scofield

The plans for the New York meeting which will be the third session of the Clinical Congress

to be held in that city will conform in a general way to those of previous sessions. The mornings and afternoons of the four days, Tuesday to Friday inclusive, will be devoted to clinical demonstrations in the hospitals and medical schools with scientific sessions each evening.

A conference on the hospital standardization program of the College and the many problems relating thereto will occupy the morning and afternoon hours on Monday. The presidential meeting, the first formal session of the Congress, will be held in the ballroom of the Waldorf Astoria on Monday evening, on which occasion the president-elect, Dr. Charles H. Mayo, will be inaugurated and will deliver the annual address. The twelfth convocation of the American College of Surgeons will be held in the ballroom of the Waldorf Astoria on Friday evening.

The Committees on Arrangements for both Brooklyn and New York have in preparation a program of clinics and demonstrations to be given in the hospitals and medical schools that will completely present the clinical activities of that great medical center. All departments of surgery will be represented therein including general surgery, gynecology, obstetrics, orthopedics, urology, surgery of the eye, ear, nose, throat and mouth, experimental surgery, surgical pathology, roentgenology, etc. It is expected that a preliminary program will be published in these pages in an early issue.





Fig



Fig

*A Progressively Enlarging Ulcer of the Abdominal Wall—Thomas S. Callen*

# SURGERY, GYNECOLOGY AND OBSTETRICS

AN INTERNATIONAL MAGAZINE PUBLISHED MONTHLY

VOLUME XXXVIII

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NUMBER 5

## A PROGRESSIVELY ENLARGING ULCER OF THE ABDOMINAL WALL INVOLVING THE SKIN AND FAT FOLLOWING DRAINAGE OF AN ABDOMINAL ABSCESS APPARENTLY OF APPENDICEAL ORIGIN

B. THOMAS S. CULLEN, M.B., F.A.C.S., BALTIMORE, MARYLAND

THE case described had a right-sided abdominal abscess about midway between the appendix and gall bladder regions. A right rectus incision was made and the abscess drained. About 2 days after the operation the incision looked red and inflamed. About 16 days later there was a wide ulcerated area where the incision had been.

About 5 1/2 weeks after operation the opening into the abdominal cavity had closed and the abdominal muscles were well united but the ulceration of the skin and fat continued to progress until finally we had an ulcer of the abdominal wall fully 12 inches across which was deep and had necrotic sloughing margins. The margins were cut away with the cautery. The wound took on a healthy appearance. It

was well covered with punch grafts and the patient made a good recovery.

At no time was there a fecal fistula nor was there evidence of escape of pancreatic fluid. No sugar was found in the urine.

The only micro-organism found was a streptococcus brevis. The Wassermann was negative. There was no evidence of blastomycosis.

The case in detail is as follows:

Mr. H. M., age 50, white, was referred to me by Dr. John H. Groshans on September 27, 1913. He had been sick for about 2 weeks and had pretty definite symptoms of appendicitis when Dr. Groshans saw him. On admission to the Church Home and Infirmary the temperature was 100.0 degrees, pulse 90, respirations 20. I thought it would be safe to wait until morning as he had been

Fig. (Front aspect). A progressively enlarging ulcer of the abdominal wall involving the skin and fat. This picture was made November 5, 1913, 6 weeks after operation. In the floor of the ulcer we see a linear depression here the incision formerly extended into the abdominal cavity. The muscles have come together satisfactorily and there is no opening whatever into the abdomen. The floor of the ulcer near the nodules shows a rather dull appearance. Here and there over the surface of the ulcer are grayish patches which look somewhat like islands of skin. The margins of the ulcer are necrotic and the necrotic tissue is under sloughing the skin. The surrounding abdominal wall shows a deep inflammatory reaction. This is pronounced just above the right anterior superior iliac spine. About 3 centimeters below the anterior superior iliac spine is a small zone of redness, scarcely separated from the area of ulceration. For the appearance of the area of ulceration about 5 and 6 weeks later, December 1, 1913, see Figure 2.

Fig. Widespread ulceration of the skin and fat of the abdominal wall following drainage of an abdominal abscess apparently appendiceal in origin. This picture was made December 1, 1913, about 6 weeks after drainage of the abdominal abscess. Along the upper margin of the abdominal ulceration there is still some necrosis but the ulcer is much shallower and the dusky zone of redness in the surrounding skin has disappeared. Near the umbilicus are two small areas that look like new skin. Covering nearly a third of the ulcer is thus, whitish filmy structure arranged in whorls and presenting a concentric arrangement. This I first seemed to be new skin. It consisted of epithelium, but beneath this culture area was pus. It was necessary to remove the whole of this filmy area. Why it presented the concentric arrangement we do not know. From this time on there was no extension of the ulceration and 4 days later skin grafts were applied. For the subsequent course see Figures 3 and 4.



Fig. 3. A large ulcerated area of the abdominal wall with punch grafts. Dr. Richard Coblenz applied many punch grafts on December 6, 1912. For the appearance of the grafts, see Figure 4.

sick so long, but as his leucocyt count was 9000 and as he had great deal of pain, we operated at once.

Midway between the costal margin and the appendic region on the right side was a globular mass, centimeters in diameter. We cut down upon this, found oedema of the abdominal wall and then entered a cavity containing at least 100 cubic centimeters of greyish, non-offensive pus. As this cavity seemed to be surrounded by intestinal loops, we did not go further but drained it.

The urine was clear, acid, specific gravity 1.05, no sugar, no albumin. A Wassermann was negative. Blood chemistry: the blood showed milligrams of sugar per 100 cubic centimeters. Dr. Hiram Fried made bacteriological examination of the pus from the abscess and found streptococcus brevis in pure culture.

September 29. The incision looks red and is flamed, but the discharge has diminished.

October 5. The temperature has been normal since operation. There is a wide sloughing area around the incision. The ulcer is bounded by a red margin about millimeters in width. A lot of yellowish green-colored pus is escaping from the sloughing margin.

October 29. The sloughing still persists in spite of all treatment. His general condition, however, is satisfactory.

November 4. The general condition is about the same as it was a week ago.

November 7. The wound in the muscle has healed completely, but the walls of the ulcer continue to be undermined and the fat is being gradually eaten away so that we now have a wound about 7 by 7 inches. This morning I took canterly and cut away the indurated and reddened area, removing about half an inch all the way round the margin of the ulcerated area. The patient stood the operation well.

Over the floor of the ulcer were whitish areas consisting of fine laminated tissue arranged in concentric rings. It looked to me as if these might be areas of young skin, but they could be lifted up and there was pus beneath them.

November 8. The incision shows little reaction around the margin. There is no discharge.

November 11. The infection seems to be clearing up except for a small area 4 centimeters in length in the region of the umbilicus.

November 24. Above and to the right of the umbilicus is an area, about 4 centimeters long and 2 centimeter broad, where the process seems to be extending a little and in the skin beyond this there is little reddening. Dr. Coblenz cut this area out with a tery but he was particularly careful not to go too deep remembering that at the umbilicus the abdominal wall is very thin.

November 30. There is very little discharge from the wound. The infection has apparently been checked.

December 6. The whole surface of the ulcerated area was covered over with fine punch grafts by Dr. Coblenz.

January 8. The grafts have taken well. The entire abdominal area is covered over with skin, and the patient was discharged today.

Repeated examinations of the ulcer failed to reveal any organism other than the streptococcus. Blastomycosis could be ruled out and the Wassermann was negative.

The walls of the ulcer consisted of necrotic tissue with but a slight inflammatory reaction in the underlying tissue.

This man was seen by many medical men and surgeons, none of whom had encountered a similar case. Dr. Thomas B. Fletcher in writing on December 3, 1912, said: "I have never seen anything like it and confess that I do not know the cause. In the absence of a sinus that might be discharging pancreatic juice and the fact that the original operation was for an appendicular trouble, a pancreatic juice origin seems to be excluded. I have seen one or two postoperative cases after pancreatic diseases where the wound has presented a somewhat similar appearance but with fat necroses. I presume that it must be due to some sort of infection."



Fig. 4. Pinch grafts covering large area of ulceration in the abdominal wall. The grafts took well. The patient was discharged January 28, 1923, about 6 weeks after the grafts had been applied.

I would suggest that all the urine be saved, mixed, measured, and a sample examined carefully for traces of sugar for several days and that a blood sugar determination on a fasting stomach be made and a sugar tolerance test be performed by giving 100 grams of glucose on an empty stomach and blood sugar determinations be made afterward on each voiding of urine examined for sugar for the next 6 hours. This is with the view of determining whether there might be a diabetic origin.

Dr. Warfield T. Longcope in his letter of December 5, 1922, said: "I was much interested in the patient named M — whom I saw at the Church Home and Infirmary yesterday. I have never seen anything like the appearance that his wound presented. It was rather an extraordinary case from many standpoints. I was particularly interested in the islands of what appeared to be epithelium over the surface of the granulations. We examined a little of the dry scale from one of these islands under the microscope and got the impression that they were masses of squamous epithelial cells."

Dr. John Staige Davis saw the man on two different occasions. In his letter of December 7, 1922, he wrote as follows: "The progress of

the disease whatever it may have been seems to have been pretty nearly stopped and in my opinion the sooner you begin to graft it, the quicker the man will recover. I would suggest the use of small deep grafts for the entire granulating area. The upper edge on which there are still a few sloughs will not interfere with the grafting. The irregular islands over the surface are unquestionably epithelium."

Dr. W. G. MacCallum after seeing this man wrote on December 8, 1922, as follows: "I went to see your patient M and it is really an extraordinary sight. It seems to me that the bacteria are still present under the loose crusts around the margins, but the curious branching area with concentric rings extending across part of the granulation tissue seems to me to be growing epithelium. I do not know why it should grow in this particular way but I thought it was the most hopeful part of the whole process. I suppose when it is cleaned up you will graft skin over the area if the man is ever to stand up straight."

Dr. Llewellys F. Barker under date of December 11, 1922, wrote as follows: "I should put the case of M under the designation *ecthyma gangrenosum* though this

form of gangrene usually is seen only in cachectic children this case seems to fall under the heading. It is sometimes spoken of when the ulcer appears as *malum terebrans*, a gangrenous ulcer which grows quickly leaving the base covered with a necrotic hemorrhagic layer.

In children it is usually met with only in cachexia, and in areas that have been contaminated by urine or feces. Probably it is of microparasitic origin. Some have incriminated the streptococcus pyogenes, others the bacillus pyocyaneus. I understood that there was a greenish color to the exudate in this case and I am wondering if the pyocyaneus could have been a factor.

Dr. Edgar R. Strobel, who saw the patient about the same time wrote me as follows: "I went to the Church Home yesterday to see M. He has truly an unusual picture. I thought of the possibility of a blastomycotic condition, but was assured by Dr. Coblenz that no verruciform appearance ever has been noticed. I examined a fresh specimen from the margin in potassium hydroxide. Nothing was found but that might have been due to destruction by the cautery."

On account of the somewhat festooned margin of the border there is a possibility of

syphilis being a factor. In view of the bacterial findings I think the streptococcus is the most active agent in the unusual spread of the disease. An amebic condition might be looked for also.

Dr. Carl Davis of Chicago who saw Mr. Brodel's water color of this ulcer wrote me as follows: "In regard to the ulceration of the abdominal wall that I mentioned while in Mr. Brodel's room I would say that our patient had a gangrenous appendix with a streptococcus and colon infection. The ulceration about the incision continued until he had a defect approximately 4 inches in diameter. It made one think of the digestive affairs that occur at times with a defect in the upper ileum. My recollection is that the patient healed after several weeks delay."

My patient gave us many anxious hours and it looked at one time as if the progressive ulceration could never be checked. The cautery knife used well beyond the advancing margin finally stopped the advance.

On December 6, 1915, Dr. Grossman informed me that the patient, apart from mild septicæmia, was apparently well.

I wish to thank my friend Max Brodel, director of the Department of Art as Applied to Medicine in the Johns Hopkins Medical School for the striking water colors which he has made of this most unusual and destructive case.

GASTRODUODENOSTOMY ITS INDICATIONS<sup>1</sup>

By CHARLES H. MAYO, M.D., F.A.C.S., ROCHESTER, MINNESOTA

THIS is a most interesting period in the history of gastric and duodenal ulcers. As to the cause of such ulcers, there has been but little discussion, most surgeons accepting the condition as they do gall stones without investigating its origin.

The early belief that there was a lack of local cell hormones which rendered a limited area vulnerable to digestion or cellular auto-digestion has been replaced by the theory that ulcers result from bacterial emboli which obstruct the terminal blood vessels and cause infarction. Gastric digestion of devitalized tissue is essential to their production and is made possible by a temporary or permanent disturbance in the chemistry of digestion. Gastric acids, varying greatly in degree, are usually present with ulcer. Even if absent, they may have been present when the ulcer first developed, but if so why has this natural Sippy treatment not healed them? Symptoms have become quite standardized while there have been many variations in the technique of treatment, based on but few principles. Within the last few years it has become generally accepted that ulcers not infrequently exist with few or no symptoms and contrary to the early theories it is now conceded that many ulcers heal with conservative treatment and often without it while others may not heal even after gastro-enterostomy.

I wish here to express my appreciation of the work of Sippy in developing and standardizing a method of medical treatment of ulcer which has produced relief or cure in a sufficient number of cases to warrant its acceptance and trial in selected cases. The surgeon has no controversy with the internist concerning patients who can be cured or benefited by treatment within a reasonable time as such cases are not referred to him. The only early cases of ulcer seen by the surgeon are as a rule those of acute perforation, or those of serious hemorrhage the former are rare as most of them especially the subacute cases are probably not diagnosed and nature seals

the opening while the latter referred in emergency are only a few of the 22 per cent of cases of ulcer in which there is recognized bleeding. Cases in which there are mild symptoms of bleeding may not be recognized as cases of ulcer more readily than those in which there is no bleeding but with severe hemorrhage they are recognized at once as probable ulcers.

The pendulum of surgical treatment of ulcer has recently described its complete arc and is now in principle back to the first operation made by Billroth in 1881. In that pre-antiseptic era of high mortality abdominal operations were performed only to relieve great distress or starvation from obstruction. Such conditions occurred in the contraction of chronic ulcer or in the obstruction of gross hypertrophic ulceration around the pylorus, or of early cancer in this region. That these pioneer surgeons in the pre-antiseptic era were able to perform successful operations is much to their credit. The results of surgical treatment became greatly improved with the advent of antiseptic and aseptic surgery.

In certain cases in which resection is difficult the operation of gastro-enterostomy which, as a principle of treatment, was recommended by Nicoladina in the same year (1881) gradually found favor. Gastro-enterostomy gave rise to many variations in technique and to mechanical improvements such as the decalcified bone plates, bone bobbins, the Murphy button and the McGraw elastic ligature each of which has had enthusiastic advocates. All of these procedures, especially the Murphy button did much to develop abdominal surgery. The greatest benefit was derived by patients with real obstruction from contracting or hypertrophic ulcer or by those whose obstructive symptoms from pylorospasm with ulcer were the most marked which unfortunately led to the operation being advocated and practiced on patients with atonic dilated stomachs, prolapsed stomachs, or pylorospasm secondary to unrecognized disease of the gall



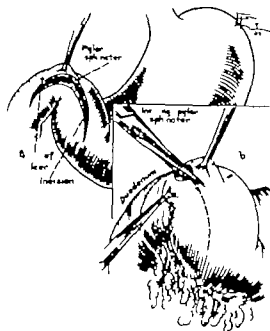


Fig. 1. Gastroduodenal flap outlined. *b*, Pyloric sphincter being divided.

bladder or appendix. Many patients are still seen who have undergone years of medical treatment for supposed ulcer with such surgical lesions causing reflex gastric symptoms. The ensuing vicious circle for all who had the operation without a local pathological cause led to the employment of a new procedure devised by von Eiselsberg of pyloric excision or pyloric occlusion. The operation was sometimes performed at the time of the gastro-enterostomy or later to overcome the new symptom if present. More accurate diagnosis and proof of the presence of a condition requiring surgery would have been profitable as it has been proved that a new opening for gastric muscular defects or slow emptying of the stomach does not eliminate the symptom. The law of gravity has but little action in emptying the stomach.

A review of the various procedures developed for the surgical relief of gastric and duodenal ulcers may be of interest as they actually represent variations of technique on but few principles. Out of this group surgeons of experience may select a method to

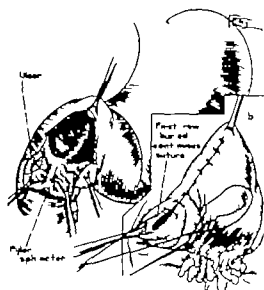


Fig. 2. Gastroduodenal flap pulled down and ulcer area to be excised. *b*, First suture being placed.

suit the individual case, based on the condition and the complications. In the first Billroth operation, a variable amount of the stomach, the pylorus, and the adjacent part of the duodenum were removed; the large section of the stomach was closed sufficiently to unite the end of the duodenum to it. Leakage at the triangular suture line was common, and the result a high mortality. After considerable experimenting, Billroth devised the second procedure in which he closed the end of the duodenum and the end of the stomach, and made a posterior gastro-enterostomy. This method was adopted by Hartman, Mikulicz, and other noted surgeons of that period. Kocher however closed the end of the stomach and united the end of the duodenum to a new opening on its posterior wall, but this never proved popular in that early period of surgical necessity for the relief of obstruction in the pylorus; other methods were sought. Heineke and Mikulicz, in 1886 without knowledge of each other's work, brought out the technique of straight division through the contracted area from the duodenum to the stomach, spreading the incision and closing the opening in the opposite direction to enlarge the outlet. The tissue was poor the

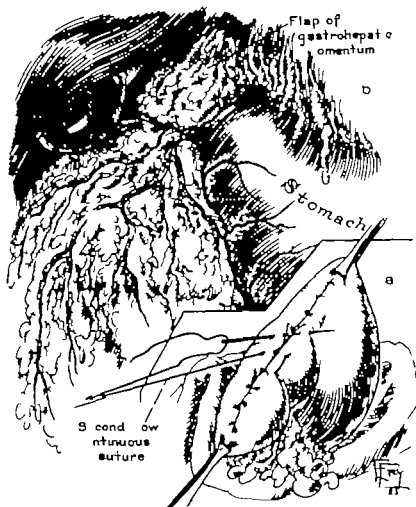


Fig. 3. Same suture returning over the first suture line. b. Same suture passes through gastrohepatic and gastroduodenal omentum holding it over suture line.

ulcer was not removed contraction occurred and good results were not sufficiently common to popularize the operation but it developed a new point of attack by enlarging the natural outlet as a surgical principle. On this principle Finney later devised the Finney pyloroplasty. At the meeting of the American Surgical Association in 1892 he reported five cases in which the operation was performed. Effort at division of the pylorus were made by Loretta and by Hahn without general success even in the pyloric contraction of infants but later Ramstedt devised an operation which has proved successful in congenital obstruction only the peritoneum and pyloric

muscle being divided. Strauss added to this the implantation of muscle and later fat at the point of division. At present however nothing is usually placed in this division. Pólya shortened the Billroth II operation by not closing the end of the stomach but bringing it through the mesentery of the transverse colon and suturing it to the jejunum like a large gastro-enterostomy. In the Pólya-Bal four operation the procedure is made anterior to the colon where space tension and in some cases a short colonic mesentery render it difficult to perform the operation in the original manner. Some years ago I suggested reversing the direction of the jejunum bringing the

proximal jejunum out of the splenic fold of colon, and passing it to the right for attachment to the stomach in the Pólya Balfour operation.

As the years have passed it has been shown that gastro-enterostomy does not always cure ulcers, and that large gastric ulcers are dangerous some of them apparently developing into cancer. MacCarty has shown that cancer is occasionally found on the margins of large gastric ulcers, but he has not found it on the margins of duodenal ulcers. It is probable that the secreting of alkalis renders the duodenal tissue fundamentally resistant to cancer. Some years ago the surgical excision or destruction of ulcers by the Balfour cautery proved popular; the patients undoubtedly benefiting by these procedures which have been continued. Judd and Rankin reported 250 cases of pyloric ulcer as being successfully treated by a modified Heineke Mikulicz technique through elliptical incisions. At times the incision crossed the pyloric line. In two cases, from necessity the pylorus was divided and the duodenal end closed and the gastric end joined at the point at which the ulcer was excised in the anterior wall of the duodenum. This is now the method of Haberer published in October 1922. The operation of Haberer which consists in closing the end of the duodenum by a modification of the Billroth I uniting the stomach to the anterior wall instead of to the end of the duodenum, is more difficult and involves the double element of duodenal leakage. The operation is of advantage in selected cases, and is now advocated by Finney whose experience in operations on the pylorus is very extensive.

I am now using a large flap gastro-duodenostomy (Figs 1, 2 and 3) instead of the narrow one of Finney but so adapted as to excise anterior pyloric ulcers, either low gastric or duodenal, the closure being made by suturing from above down, beginning at the division of the pyloric muscle and suturing the duodenum to the stomach. The line of suture is continued out on the flap of duodenum and stomach greatly enlarging the pyloric opening and lowering it. The operation is only half as extensive as a gastro-enterostomy. It does not empty acids into an area

of small bowel unaccustomed to them. It cannot be followed by the serious consequences of gastrojejunal ulcer or gastrojejunal-colic ulcer with fistulae possible results which are definite risks to be considered when a posterior gastro-enterostomy is made. If it is difficult to reach the pylorus it is inadvisable to perform the pyloric operation on obese patients, other methods being safer or on those in whom the pylorus is bound deeply to the pancreas, and is difficult to elevate. The procedure does not lower the gastric acids to the same degree as does gastro-enterostomy; this is a consideration when gastric acids are tested. The risk is equal and either procedure is often equally possible. Yet it must be admitted that gastrojejunal ulcers are more common in cases in which high acids empty into the jejunum which is not fitted to receive them. Gastro-enterostomy even with its indiscriminate general application, has been an eminently successful procedure when properly performed in cases of proved ulcer or obstruction due to ulcer. Ill results will occur in only a small percentage. Years ago when permanent suture material was used for the operation, undoubtedly gastrojejunal ulcer resulted in 5 or 6 per cent of cases but with greater care better operative technique and absorbable suture material probably not more than 2 per cent result today.

The effort to advance the adoption of the procedure of upper duodenal and partial gastric resection which was started in continental Europe, passed through England, and has reached this country by endeavoring to discredit gastro-enterostomy as having a high percentage of failures, frequent secondaries, and a high mortality was a great mistake. Gastro-enterostomy has established its record. This resection is performed beautifully by Moynihan, Shoemaker, Finsterer and many other surgeons, but cannot be performed by the average surgeon with so low a mortality or so high a degree of successful relief. Yet the operation has its place in an increasing number of cases. The loss of gastric acids will in some cases later cause disagreeable symptoms. Finsterer is doing a good work in furthering the knowledge of the truth that methods of anesthesia can be adapted to the

needs of the patient, regional anesthesia being satisfactory when indicated.

It will take a number of years to secure comparable data on the new methods of treating simple ulcer by such radical measures as advocated. I believe that but few surgeons today would permit the primary resection of a large part of the normal stomach on themselves for the relief of a small duodenal ulcer. If the outlet new pylorus in the Billroth I is small, slight division of the anterior wall of the duodenum will enlarge its perimeter for suture to the stomach. The danger of leakage from gastric resection is greatly reduced by the W. J. Mayo procedure of drawing a fold

of the omentum through the opening in the gastrocolic membrane behind the stomach to reach and cover the suture line of the lesser curvature as well as the posterior gastroduodenal incision, and to prevent adhesions and fixations of the stomach to the pancreas. The anterior suture line is covered in the same manner by a strip or fold of omentum.

From these various procedures it is hoped that, in the next swing of the pendulum the patient will secure the best possible results by the choice of that method which will be most effective and can be executed with the least risk to the patient, according to the individual operator.

## THE BONE CHANGES IN RECKLINGHAUSEN'S NEUROFIBROMATOSIS

By BARNEY BROOKS, M.D. AND EDWIN P. LEHMAN, M.D. ST. LOUIS, MISSOURI  
From the Department of Surgery, Washington University School of Medicine

THE characteristic findings of Recklinghausen's disease (1) are so striking that when these findings are present the condition is unmistakable. The characteristic findings of this disease are multiple pedunculated soft tumors distributed over the entire body associated with areas of pigmentation. The tumors may be distributed in the skin corresponding to the distribution of a cutaneous nerve or along a nerve trunk itself. On macroscopic section these tumors are neurofibromata. The pigmentation is characterized by irregular coffee-colored spots in the skin. These pigmented areas may be widely distributed over the entire body. There is, however, a characteristic distribution about the pelvis and thighs which has been termed "bathing trunk pigmentation."

Associated with the classical picture of Recklinghausen's neurofibromatosis, there have been frequently noted (2, 3) other conditions of a widely varying character such as mental deterioration and congenital developmental defects, such as spina bifida, hypoplasia, glaucoma, elephantiasis, scoliosis, and other soft tissue and skeletal deformities.

One gets the impression that these various anomalies have heretofore been considered as being accidentally associated with Recklinghausen's disease. Stahnke (8) has pointed out that the entire disease has the stamp of a congenital anomaly in the broadest sense. A direct heredity has been noted in a considerable proportion of cases (6, 9).

From the study of seven cases in which bone changes were found it has seemed that at least some of these changes are characteristic of this disease. The purpose of this paper is to describe these changes and to emphasize their importance as characteristic manifestations of Recklinghausen's disease.

### CASES

CASE 1. W. F. H., male, 19 years of age, white (Figures 1, 2, 3, 4, and 5). First entered St. Louis City Hospital, October 7, 1917 at the age of 13 years.

His family history was negative. His history at that time recorded a pigmented area over the right hip and strabismus, both present since birth, scoliosis, and a tender tumor of the right buttock and lumbar region, present for 13 months and having grown to the size of a fist. At operation, the tumor was seen to be associated with the lumbar nerves and to pass forward toward the iliac region. It was partially excised and the patient received X-ray



Fig. 1. (left) Case. Scar was and permeated area with skin pencil. Year of operation at age of 3 in right hamur region and buttock.

Fig. Case. Area of pigmentation outlined with pencil. Inner line on front aspect of thigh represent roughly the area corresponding to the right external cutaneous nerve distribution so such multiple tumor masses occur. Scar than this area is the result of recent biopsy.

treatment for some week. The pathological diagnosis was sarcoma.

He returned to the hospital March 6, 1911, complaining of reappearance of the tumor. Examination showed broad band of brownish pigment almost surrounding the pelvis (Fig. 2) an irregular mass of nodules under and about the old operative scar in the right buttock, three small nodules in the skin of the abdominal wall, mass of nodules in the subcutaneous tissue, the anterior surface of the thigh exactly corresponding to the distribution of the external cutaneous nerve (Fig. 3). One of the latter was excised and microscopic diagnosis of neurofibroma was made. Other laboratory examinations with the exception of the X-ray findings, were negative.

The bones he gets observed were as follows: (1) scapulae, (2) right 11th dorso-lumbar ridge, (3) distal ends of spinae iliacia (Fig. 3), (4) the region of the anterior superior spine of the right humerus, (5) rounded projections. The centers of these were clearer than the periphery, which the first border appeared to consist of the shaft of bone (Fig. 3). (3) Three small clear spaces, the lower end of one femur (Fig. 4) and the lower end of the other femur (Fig. 5). The latter showed a definite cortical or periosteal position, the thin bridge of bone covering it just as the iliac bones.

CASE 2. 11 male age 11 (Figures 6, 7, and 8). Latered St. Louis Children Hospital October 7, 1917 complaining of deformed leg. At the

(see Case 1) 41 years old, had the same condition in the leg as the boy. Mother stated that none of her mother's sisters had both legs in similar state. This person lived to be 70 years of age. The child had always been a good berish. He was born with the present condition, the left leg. For past 30 years the leg had been getting larger and larger. Mother stated that the legs were the same length during early childhood.

Examination showed the following:

The boy was well developed, 5 feet 6 inches tall. Scattered over the body were brown pigmented areas (Fig. 6). No hair on the body. A congenital glaucoma was present in the right eye. Chest and abdomen were negative. Reflexes of extremities normal. Left leg was twice as large as right (Fig. 6). Foot everted, toes close together. There was a bony prominence at the proximal end of the shaft of the tibia measuring 7 by 1 centimeters. Fibula leg was soft and doughy. The astragalus and calcus were displaced laterally. No paralysis.

Measurements

	Right cm.	Left cm.
Anterior superior iliac spine to malleolus	76	87.5
Trochanter to malleolus	71	80
Length of femur	30	37
Circumference of knee	30	3
Length of tibia	36	44
Circumference of ankle	5	
Circumference of calf		23

The spine showed moderate degree of scoliosis. No glaucoma appeared after 100 grains glucose. Other laboratory findings were negative with the exception of the X-ray.

Bone changes: (1) Lengthening of left tibia (see measurement of boy). (2) Attached to the upper end of the left tibia was large oval tumor, the thin bony shell (Fig. 7 and 8). (3) On the surfaces of the tibia and fibula were at least 10 small lesions, flat and not resembling raised periosteum (Figs. 7 and 8).

No. 1003 3, 9, 7 the large tumor, the tibia was excised. Microscopic examination showed typical neurofibroma associated with the formed bone trabeculae.

CASE 3. E. H. female, born age 4, married (Figures 9 and 10). This patient is the mother of the boy (Case 2). She never in the hospital and no complete record to make. Examination showed an pigmented area and many soft pedunculated tumors (Fig. 9).

A nodule excised from the arm showed neurofibroma on microscopic examination.

Bone changes: No X-ray photograph of the right leg could be obtained for study. It showed (1) roughening of the tibia surface (Fig. 10), (2) bowing and enlargement of the fibula (Fig. 10), (3) just at the lower edge of the plate a space strongly suggesting one of the periosteal cysts described in the foregoing cases (Fig. 10).



Fig 3. Case . Pelvic lower spine. Arrows point to perineural cysts near right anterior superior spine. These are in direct relation to the external cutaneous nerve, along which the disease has spread from the lumbar region.

**CASE 4.** R. D. female, white, age . Patient entered St. Louis Children's Hospital complaining of a growth on the ankle. The father was suffering from an advanced stage of Recklinghausen's disease with an eighth nerve tumor and slight thoracic scoliosis (Fig. 1). Patient's brother, dead, had condition similar to that of the father. The child had suffered from the disease since 9 months of age. Her general health had been good. The tumor (right ankle) was first noticed when child was 3 years old. It had gradually grown in size and was sometimes painful.

The right leg showed proximal to the lateral malleolus a swelling 6 by 6 centimeters. It was extremely soft and attached to the skin. The skin over the tumor was shiny but not pigmented. There was a general increase in pigmentation, most marked about the hips. About the waist line were several dark brown areas of pigmentation. There were several very small soft papules in the skin widely distributed.

Laboratory examination was negative. X-ray photographs of both legs were negative.

**Bone changes.** ( ) Scoliosis ( ) spina bifida, fifth lumbar.

**CASE 5.** E. G. female, white, age 4½ years (Fig. 3). Entered St. Louis Children's Hospital, August 7, 1938, complaining of lump on the back. Family history negative. The child was normal at birth. She walked at 2 years of age. She was slow to talk and did not talk plainly. At 1 year of age, mother noticed lump in the lumbar region. This lump had progressively increased in size.

Examination showed very marked scoliosis. In the left lumbar region was large soft non-pulsating mass not tender. Skin over the abdomen and back and on some extent on the extremities showed areas of pigmentation. Largest area of pigmentation was over the region of the tumor. This area was 20



Fig 4. Case . Lower end of femur showing cysts.  
Fig 5. Case . Lower end of femur showing cortical cysts.

centum centimeter diameter. Examination including laboratory examinations was otherwise negative.

On August 20, 1938, a 2-inch incision was made through the discolored area. The skin of the back, the subcutaneous and deeper tissue was soft white, glistening, nodular tissue which did not bleed. A section was removed for study. Microscopic diagnosis: neurofibroma.

**Bone changes.** Scoliosis (Fig. 3).

**CASE 6.** Male, white, age 9 years (Figs. 4 and 5). This case was furnished us through the courtesy of Dr. M. L. Klinefelter. The patient had multiple pigmented nodules with typical patches of coffee-colored pigmentation and an area of elephantiasis in the left thigh which was several centimeters longer than the right. Unfortunately, complete history and physical examination were not available.

**Bone changes.** ( ) Scoliosis dorsolumbar, left slight grade (Fig. 4). ( ) left femur longer than right (3). ( ) coxa alta, left, with irregularities of cortical structure of trochanters and shaft (Fig. 5). (4) cortical cysts of ischium and ilium (Fig. 5).

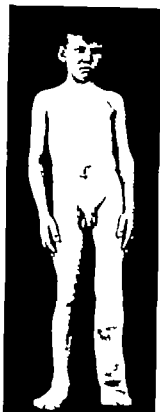


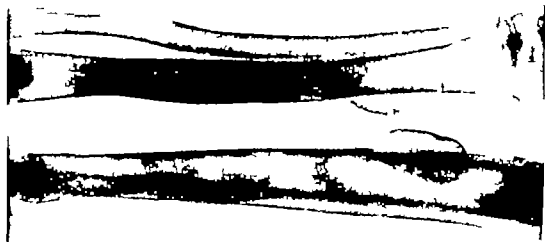
Fig. 6 Case . Note pigmented areas, elephantiasis, greater length of involved leg and prominence over upper third of tibia.



Fig. 9 Case . Note scattered pigmentation and typical multiple skin tumors.

CASE 7 O C female, white, age 3 years single (Figs. 6, 7, 8, 9, 20, and ). Patient entered Barnard Free Skin and Cancer Hospital in June, 1923, and was referred to us by courtesy of Dr. M. F. Engman. The family history and past history were unimportant. Patient had noticed multiple tumors, skin and pigmentation for 9 or 10 years, but they might have been present longer. She had limped for about the same period on account of greater length of left leg than right. A bony tumor had been removed from the right leg just below the knee about 10 years ago. She had noticed recently a swelling in the right clavicula region and a hard lump in the left abdomen.

Examination showed a well-nourished young woman of average mentality, the surface of whose



Figs. 7 and 8 Case . Anteroposterior and lateral views. Hypertrophied tibia with periosteal lesions. The largest one was removed and shows microscopically neurofibroma associated with new formed bone.



Fig. 3. Case 3. Showing skin tumors and elephantiasis. Ant. X ray of the leg (Fig. 4).



Fig. 4. Case 3. Lower end of right tibia and fibula, showing irregularity of shaft of bone. Arrow points to possible cortical cyst.



Fig. 5. Father of R. D. Case 4. Note slight scoliosis.



Fig. 6. Case 5. Shows marked scoliosis. (Courtesy of Dr. M. L. Kincaid.)





Fig. 4 Case 6 Slight scoliosis (Courtesy of Dr. M. L. Khosla)



Fig. 5 Case 6 Showing coxa valgus, cortical cysts in pelvis and ilium and irregularity of cortical structure of femur of the longer leg (Courtesy of Dr. M. L. Khosla)

body was covered with scattered tumors and plaques of coffee colored pigment (Fig. 6). The tumors were extremely soft and tended to be pedunculated. Just below the right knee the external surface of the leg was broad white, operative scar. The left lower abdomen just above the anterior superior spine, there was a hard, spherical, non tender tumor about 3 centimeters diameter. It was fairly freely movable but seemed to be fixed in position by contraction of the abdominal muscles. Attached anteriorly to the right clavicle was a hard, sessile rounded, non tender tumor, about 5 centimeters in diameter (Fig. 8). It did not interfere with the function of the shoulder. There was marked dorso lumbar scoliosis to the right standing this diminished in degree when the patient was seated (compare Figs. 6 and 7). The left leg was longer than the right, but there was no marked difference in diameters.

#### Measurements

	Right Cm.	Left Cm.
Anterior superior spine to malleolus	8	90
Length of tibia	37	37
Circumference of thigh at perineum	58	58.5

Measurements of femur	Right plates Cm.	Left plates Cm.
Top of trochanter to lower surface of external condyle	39.5	45.3
Highest point of head to same point	42.6	48.8

*Remarks.* (1) Scoliosis, increased by standing on account of unequal length of legs (Figs. 6 and 7). (2) Left femur 6 to 8 centimeters longer than right (Fig. 6). (3) Marked coxa valgus right with smaller diameter of head neck, and shaft (Fig. 9). (4) The contour of the shaft of the right femur was irregular with marked deposit of periosteal bone (Fig. 10). (5) In the right acetabulum and greater trochanter there were also irregularities of contour suggesting the type of subperiosteal cysts has seen in Cases 1 and 6 (Fig. 9). (6) The lower end of the right femur as occupied by a large irregular cystic cavity penetrating the cortex in the manner described in other cases. It involved the line between epiphysis and diaphysis and must have interfered with growth in length of this femur (Fig. 10). (7) The upper end of the right fibula was abnormal, but how much this abnormality as due to the earlier operative procedure was not clear. The shafts of the fibula and of the tibia showed periosteal

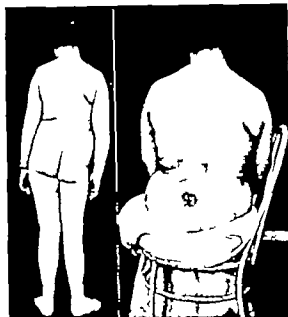


Fig. 6 (left) Case 7. Not pigmented areas skin tumors, greater length of left leg, and scoliosis.

Fig. 7 Case 7. Compare with Figure 6. The decrease in scoliosis with the patient sitting is striking.

irregularities (Fig. 8) (8) Attached to the middle of the right clavicle as a periosteal cyst of the pedunculated type occurs; in other cases (Fig. 9).

#### DISCUSSION

In the study of these 7 cases the following types of bone changes have been found: (1) scoliosis; (2) abnormalities of growth; and (3) irregularity of outline of the shafts of long bones including changes which in the X-ray picture appear as subperiosteal bone cysts.

Of these changes, scoliosis has been universally present in all cases examined. Lingman and Weiss (7) have also noted that scoliosis was present in 15 cases of Recklinghausen's disease which they had studied. It would seem that although scoliosis is not characteristic of this disease it is almost universally present.

In Case 5 the scoliosis was extreme in early childhood and scoliosis has been noted previously as a congenital deformity associated with Recklinghausen's disease. In Cases 2 and 6 in which scoliosis was of slight grade in a child it was no more than would result from the inequality in the length of the lower



Fig. 8 Case 7. Showing swelling over the right clavicle from the underlying periosteal cyst.

extremities. In Case 7 in which also the lower extremities were unequal in length, the scoliosis, present when the patient was sitting, was increased on standing. It would seem therefore that the scoliosis almost universally



Fig. 9 Case 7. Showing changes in right acetabulum and upper end of femur. Note cortical cyst in acetabulum and possibly also in greater trochanter. Costal alga and another character of head, neck and shaft.

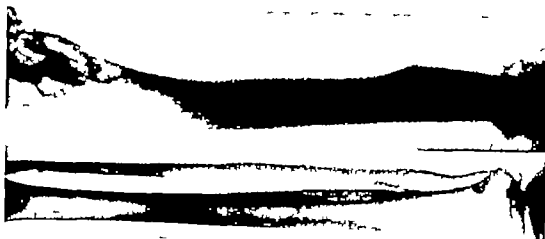


Fig. 30 (above). Case 7. Showing marked periosteal irregularity of right femur and large irregular cortical cyst involving the distal epiphyseal junction.

Fig. 31. Showing periosteal irregularities of right tibia

present in Recklinghausen's disease may have different causes. On the one hand it may be due to primary changes in the spine, possibly developmental, possibly related to the changes in the long bones to be discussed. On the other hand scoliosis may in certain cases be compensatory for unequal length of the lower extremities. The two causes may operate together in a single case.

Excessive growth in length of long bones was noted in Case 2 (tibia) and Case 6 (femur). Examples of such changes are found in the

and fibula. The upper end of the fibula appears cystic, but as thin as the site of an operation years earlier for the removal of bony tumor the shadow may represent certain amount of removal of the cortex.



Fig. 32. Showing irregularity of right clavicle and pear shaped periosteal cyst attached at junction of acromion and middle third.

literature (2, 3, 5, 8). Also it is well known that in rare instances of acute inflammatory disease of bone, hypertrophy both as regards length and thickness of a bone occurs (10) but we know of no other condition in which there is a spontaneous excessive growth in length of a single long bone other than Recklinghausen's disease. In the instances in which this has been noted it has usually been associated with a congenital elephantiasis. Always the bone which has been affected in growth has been the bone or bones in the region in which the elephantiasis existed.

In Case 7 there was also a marked inequality in the length of the two femurs, but in this instance apparently the longer bone was normal. The proximal end of the short femur resembles that of the abnormally long femur in Case 6 that is, there is diminution of the size of head, neck, and trochanter with a marked *cova valga* and abnormality of the bone structure of the acetabulum and the greater trochanter. It would seem probable from this comparison that the short femur in its upper half was reacting to the disease in exactly the same manner as the long femur in Case 6, the result of which reaction would have been an abnormally long bone. However, the distal end of the short femur in Case 7 shows involvement of the junction of the epiphysis and diaphysis by the cystic changes

to be discussed later changes which must by direct destruction of the epiphyseal cartilage have resulted in marked inhibition of growth at this center. The net result is a short rather than a long bone. In this way Recklinghausen's disease may cause abnormalities of growth in length in either direction.

The irregularity in outline of bones which was found in Cases 1, 2, 3, 6, and 7 varied from very slight irregularity of the periosteal and cortical structure of the bone to large tumors projecting from the surface of the bone or embedded as cyst-like cavities in the structure of the bone. The X-ray appearance of these tumors is that of a bone cyst. The microscopical examination of one of these tumors, however, has shown that the central portion of the tumor was composed of tissue similar to that found in the skin tumors associated with new formed bone trabeculae.

All of the bone changes which we have observed can be explained on the basis of the involvement of the bone by the growth of the tumor tissue which is characteristic of Recklinghausen's disease. With the development of a neurofibroma of a nerve in the periosteum, there is set up a certain amount of reaction and bone destruction and regeneration follow. If in the process of the development of the tumor the osteogenetic element of the periosteum comes to cover over the tumor then a thin shell of bone is formed over it and thus the X-ray appearance of a subperiosteal bone cyst is produced. If the tumor growth further involves the substance of the shaft of the bone and particularly if the growth of the neurofibroma is associated with a hyperplastic change in the lymphatics then the entire bone is rendered more porous and more plastic. In the process of growth this results in a growth in length of the bone, which is distributed throughout the entire bone instead of being confined to the region of the epiphyseal cartilages, and an abnormally long bone results. If the growth of tumor tissue is so placed as to destroy the epiphyseal cartilages, then the result may be an abnormally short bone. The entire process may be compared to osteomye-

litis. If the infection is limited to the shaft and persists for a long period during childhood, the length of the bone may be abnormally great. If the infection destroys the epiphyseal cartilage the bone is abnormally short. This abnormal softening of the bones by invasion of the tumor growth could also explain the scoliosis. The fact that scoliosis is so universally associated with the disease would be explained on the basis that the vertebrae are closely associated with the peripheral nerves. It is to be emphasized however that scoliosis may at least in part be due to asymmetrical growth disturbances of the lower extremities.

These observations emphasize the fact pointed out by Gould (5) that Recklinghausen's neurofibromatosis is a condition affecting bone as well as skin and nerve. The fundamental process in the disease is one of tumor growth. It has long been known that the result of this tumor growth is to produce characteristic clinical manifestations in the skin and nerves. These observations indicate that equally characteristic clinical manifestations develop in the bones. The recognition of these changes in the bones is of diagnostic importance particularly in those instances in which the complete clinical picture, heretofore considered classical, is not developed.

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# SPLENECTOMY AS A TREATMENT FOR PURPURA HÆMORRHAGICA (THROMBO-CYTOLYTIC PURPURA KAZNELSON)

WITH REPORT OF A CASE AND A REVIEW OF LITERATURE<sup>1</sup>

By ISIDORE COHN, M.D., F.A.C.S., NEW ORLEANS, LOUISIANA

Professor Clinical Surgery, Tulane University; Associate Senior Surgeon, Texas Eastern

AND

I. I. LEMANN, M.D., NEW ORLEANS, LOUISIANA

Professor Clinical Medicine, Tulane University

INVESTIGATORS have busied themselves in attempts to determine the etiology of purpura hæmorrhagica. Early writers recognized that the clinical picture was often associated with certain infectious diseases in which the subcutaneous bleeding was secondary.

As early as 1775 Werlhoff attempted to separate from the hæmorrhagic diseases a group of cases which he called purpura hæmorrhagica.

Letzerich in 1884 isolated a bacillus which he believed to be the cause of primary purpura hæmorrhagica. By injection of rabbits with cultures of this bacillus he was able to produce hæmorrhages, enlargements of the gums, and other changes incident to the disease. He was able to recover these bacilli or their spores from blood vessels of different parts of the body. "From his experiments Letzerich considers purpura hæmorrhagica a chronic infectious disease. Three years after these experiments Letzerich became affected with a long lasting purpura complicated with a large tumor of the liver (Litten-Nothnagel's System)."

Levoid in 1884 distinguished between purpura in which there existed changes in the vessels and purpura with changes in the blood itself. Later developments indicate that an element of truth existed in this classification.

Frank writes: "In 1887 Denys observed that in a case of purpura the blood platelets which had been described by Hayem and Bozzozero were entirely missing. He thereby found the key to the understanding of this interesting disease. Frank further states: 'I am convinced that upon this almost forgotten presentation of Denys every explanation of purpura must be based.'

These observations have led the way for investigation and interpretation of this disease which prior to treatment by transfusion and later by splenectomy presented an almost hopeless outlook for cure.

Even the best medical encyclopedias (such as Nothnagel) as late as 1905 made no mention of the association of a diminished platelet count in purpura. The origin of platelets, their significance, function, and fate have been subjects of study by laboratory investigators for the past 20 years. It was startling to find how uninformed many of us were on this subject—a subject apparently so vital in the differentiation and treatment of hæmorrhagic diseases.

Without presenting the views of the workers in this field, it will be impossible to present splenectomy as a clearly favorable method of treatment for purpura hæmorrhagica. We therefore will quote freely from the literature.

In 1906 J. Homer Wright, of Boston demonstrated that platelets originated from the megacaryocytes of the blood-forming organs.

Frank, in 1915, stated relative to the origin of platelets: "their source of origin has caused a great deal of discussion and I am of the opinion that the original contribution of J. H. Wright is a satisfactory explanation."

According to Lee and Minot megacaryocytes occur normally in bone marrow. This observation has been confirmed by Krumbharr and others.

Lee and Minot further assert that in disease, in embryonic life, and in the lower animals, megacaryocytes are formed in the spleen as well. This observation gives a basis for hypotheses to explain the presence of megacaryocytes in the spleen in cases of purpura.

One of the most important contributions to this subject is the exhaustive monograph of Professor Foa of Turin. He does not deny Wright's statement, but states that this theory is not easily confirmed.

Paul Karmelson, in 1919 accepts as proven Wright's theory of the origin of platelets in the following words: "Blood platelets are formed out of the protoplasm of megacaryocytes."

American writers including Giffin Brill and others seem to take for granted that the origin of platelets has been proven. For our purpose I believe that we must accept this attitude and state that we believe that blood platelets represent a definite blood entity and that they are derived from the megacaryocytes of the bone marrow.

It will not be possible to discuss the function of platelets except as they are related to hemorrhage, coagulation, and bleeding time. The present hematological picture of purpura hemorrhagica as established by Hayem and Duke (according to Mouson) consists of (1) diminished platelet count, (2) normal coagulation time, (3) prolonged bleeding time, (4) and a non retractile clot.

The diminished platelet count is the characteristic and outstanding mark of the disease (Karmelson). This poverty of platelets has caused Frank to call the disease "essential thrombopenia" (or poverty of thrombocytes) and Karmelson to call the disease "thrombocytolytic purpura."

These two theories of the origin of the disease although they represent opposite views lead to the same conclusion that splenectomy is a means of cure of the disease.

That platelets may not be the only factor in the production of the disease cannot be disputed but one thing is certain we may say that a diminished platelet count bears the same relationship to purpura as the fall in the blood pressure does to shock or the thermometer to febrile reaction, *they are the indicators*.

Platelets as stated before are derived from the megacaryocytes of the bone marrow. Conditions which activate the bone marrow increase the platelet count and vice versa. Inhibition of the marrow actually diminishes

the platelet count. According to the observations of Lee and Minot, "the number of platelets as a test of bone marrow activity is of great value." After hemorrhage a great increase of blood platelets indicates a satisfactory attempt for blood regeneration. Lee and Minot further state: "It is generally agreed that the blood platelets furnish a substance which hastens coagulation." According to Howell this substance is called thromboplastic substance. Morawitz found that platelets contain large amounts of prothrombin, the antecedent substance of the fibrin ferment. Stanhope B. Jones confirmed Morawitz's results and in addition demonstrated that platelets liberate a thromboplastic substance which he called thromboplastin. (W. W. Duke.)

Lee and Minot state: "Of the formed elements of the blood the platelets alone play any considerable part in coagulation." Franz Sternberg, discussing thrombocytes or platelets, makes the statement: "the important blood coagulation function of the thrombocytes is today assured."

Bordet and Delanges in their theory of coagulation (accepted by Frank and others) state: "Thrombin, the active coagulating principle, is not present in the blood but is formed by the union in a calcium medium of two substances, cytotoxyme and serotoxyme. The thrombin then coagulates the fibrinogen. Calcium is not necessary for this step. Cytotoxyme is derived chiefly from the blood platelets and to a certain extent from the leucocytes (Lee and Vincent)."

One may then accept the following as proven with regard to platelets:

1. They are derived from megacaryocytes.
2. They are the most important formed elements which take part in coagulation by producing a thromboplastic substance.

#### ANTIPLATELET SERUM—EXPERIMENTAL PRODUCTION OF PURPURA HÆMORRHAGICA

With the establishment of the constant association of diminished blood platelets and purpura hemorrhagica, attention has been turned to the cause of this diminution of blood platelets and to experimental production of this condition. (Lee and Robertson.)

Cole in 1907<sup>1</sup> produced an antiplatelet serum by repeated injections of alien blood platelets. LeSourd and Pagniez, infected animals intravenously with antiplatelet serum and were able to produce a condition of the blood closely resembling that found in purpura hemorrhagica. There was a rapid disappearance of platelets the blood clotted in the normal time but the clot failed to retract. They had previously showed that retraction of the clot depended on an abundance of platelets. These findings were confirmed by Achard and Aynaud. Ledingham, also confirmed these findings.

Lee and Robertson injected guinea pigs with antiplatelet serum subcutaneously intraperitoneally and directly into the heart. Three animals were given subcutaneous injections of a cubic centimeter each. All developed purpuric spots. The bleeding time increased from 3 minutes to 30 minutes and the platelet count dropped from 300,000 to 10,000 in 24 hours.

These experiments showed the association of platelets and purpura. They proved that an antiplatelet serum might produce purpura and further showed that though the platelets were destroyed the active coagulating substance derived from platelets was not disturbed.

There are two other characteristic hematological findings in purpura prolonged bleeding time and a non-retractile clot.

According to Kaznelson. The close connection between blood platelets and bleeding time appears beyond all doubt to have been established. Kaznelson states that Duke Denys, and others have contributed to the establishment of the above truth.

From these quotations we see that all of the characteristic hematological findings of purpura are associated with the production, destruction, or the action of platelets.

Purpura hemorrhagica is specific in its manifestations. It is probably the resultant of many etiological factors. Whatever factors produce the manifestations must disturb the hemostatic and hematopoietic systems in a like manner. The platelet count is always diminished in purpura. It follows then that there are only a few theoretical possibilities.

1. That platelets are not formed in a normal quantity. This would imply that there is either an aplastic condition, or an inhibition of the megacaryocytic production of bone marrow.

2. That platelets are formed in normal number but that they are destroyed somewhere in the body by an antiplatelet serum which is the product of hyperactivity of one or more organs.

The first of these ideas has been championed by E. Frank, of Breslau who called the disease essential thrombopenia. The latter idea was woven into a theory by Kaznelson, of Prague who called the disease "thrombocytolytic purpura." Each of these workers, from theoretic considerations and by analogy from experimental results, arrived at the identical conclusion that splenectomy is indicated as a curative procedure in the treatment of purpura hemorrhagica.

The natural question is, why should a splenectomy be done? Is the operation done because authority has suggested it, or is there a rational scientific basis for the operation? What are the findings in a normal animal after splenectomy? I believe from a study of the literature that there is sufficient evidence to warrant one in feeling that this is a scientific rather than an empiric operation.

It will serve our purpose best to cite the reasons that led us to splenectomy in the words of the original workers. Since Paul Kaznelson was the first to suggest splenectomy for purpura hemorrhagica I will give his views first. He is unwilling to believe that the condition is one of diminished production of platelets. This would indicate "he says, "that the megacaryocytes of the bone marrow are entirely isolated as individual elements, and either injured or destroyed. It appears to us that such an isolation and so great an injury to the megacaryocytes, without the least participation of other bone marrow elements, as would be necessary to explain the changed blood picture in reference to blood platelets is without analogy.

Kaznelson further states. Were the megacaryocyte apparatus really injured (as Frank and Glanzmann assume) it is hardly possible to imagine that within a days after splenectomy there was increase from 300

platelets to 600,000 that is a 2 000 fold increase. We know through the researches of Duke that it requires about 5 days for the mother cells of blood platelets in the case of normal animals to reach their normal count.

We have noted as a characteristic feature of our three cases an extraordinary rise of the blood platelet curve. The maximum was reached at the latest the third day after the operation. Morphological details in connection with a small number of platelets which in cases of essential thrombopenia are usually abnormally large refute the theory of an injury to the bone marrow giant cells. These large forms are usually found in conditions of stimulation of megacaryocytes. All of these facts make it seem most highly probable that the production of the blood platelets is primarily in no way injured. Kazznelson's attention was directed toward the second possible cause for the diminished platelets in the blood of these patients. Of four cases observed three had an enlarged spleen. Duke, Bensaude and Rivet, Hayem and others had made similar observations.

Kazznelson says: "This frequent appearance of a spleen tumor in essential thrombopenia must have had an especial significance."

Aschoff, Foa and Carbone and others helped us to recognize the closer connection between thrombopenia and spleen tumor because they suggested that the spleen is the organ which destroys platelets. Port and Aiyama observed an increase in the platelet count after splenectomy in normal rabbits."

Kazznelson then draws this conclusion: "So we came to suspect that we must look upon the spleen tumor in our cases as the expression of an intensified function of the spleen tissue leading especially to the conclusion that blood platelets are being destroyed in larger number than was normal, and therefore an increased destruction of thrombocytes was going on in the spleen. On the basis of these findings we advised a patient to submit to splenectomy."

E. Frank, who named the disease essential thrombopenia, believes that there is an inhibition of the megacaryocytic function on the part of the spleen. The spleen according to

his theory produces a myelotoxin. The majority of writers agree in the main with Kazznelson.

Keisman states: "This disease is due to disturbance of the physiological function of the spleen. It is a dysfunction."

Franz Sternberg, of Budapest says: "The thrombopenia, however it develops, is probably due to changes in the cellular system scattered through the spleen, the liver and certain lymph glands."

Kazznelson was not unaware of the fact that the spleen was not wholly responsible for the disease. He too believes that the entire reticulo-endothelial system is at fault. For proof of this see his warning: "With the removal of the spleen we in no wise removed the only cause of the disease. In fact the spleen is only a part of a great system which Aschoff and Landau have named the spleen apparatus or reticulo-endothelial system."

The hyperfunction which we assume as pathogenesis of thrombolytic purpura might be localized in various parts of the system so that the success of splenectomy is greater the more seriously other parts are affected.

Finally he says: "The evidence which appeared after splenectomy in our three cases brings us new support to our suspicion that this form of hæmorrhagic diathesis rests upon increased thrombocytolysis."

E. B. Krumbharr's very interesting article in a recent issue of the *American Journal of Medical Sciences* supports the view that the reticulo-endothelial system aids in destruction of platelets.

To summarize the theoretical considerations which have been presented it may be well to state certain accepted facts:

1. Platelets are derived from a parent cell which has its origin in bone marrow, the megacaryocyte.
2. In purpura hæmorrhagica the platelet count is greatly diminished.
3. Evidence points to the fact that they are formed in normal number but that they are destroyed by the spleen and other members of the reticulo-endothelial system.
4. Coagulation time in purpura hæmorrhagica is normal. The only formed element which takes an active part in coagulation



is the platelet which produces a thromboplastic substance. *If the platelets were not formed in normal numbers there would be a deficiency of thromboplastic substance and prolonged coagulation.* This evidence certainly lends weight to the thrombocytolytic theory of Kaxnelson.

5 Splenectomy is followed almost immediately by a great increase in platelets. This could not occur if the condition was due to a diminished production.

6 It is hardly reasonable to suppose as Kaxnelson has pointed out, that an inhibition of only a portion of the bone marrow activity could occur.

7 It is plausible and rational to believe that the spleen and other members of the spleen apparatus may and do cause by hyperviscosity a destruction of platelets and therefore that splenectomy is the logical treatment for purpura hemorrhagica which does not readily respond to repeated transfusions. Duke has confirmed this observation.

Reference to the platelet count in our case shows that by this standard we were dealing with purpura hemorrhagica.

Hæmophilia is another condition from which purpura hemorrhagica must be differentiated. In hæmophilia the platelets are present in normal quantities (Frank). "In hæmophilic blood there seems to be a relative excess of antithrombin owing mainly to an actual diminution in the amount of prothrombin (Howell). Hæmophilia presents the familial history. In purpura there is no relation to inheritance or to occurrence in other members of the family (Frank).

According to the present conception of the blood findings in the various hemorrhagic diseases, *splenectomy is not indicated* in hæmophilia and purpura simplex.

It is surprising to find how little attention is given to the platelets. Turn to MacLeod's work, *Physiology and Biochemistry* and you will find four lines devoted to platelets. Many laboratory men with whom I have talked have given no time to platelet counting. It is hoped that the great mass of convincing literature on the subject which has been accumulating since Kaxnelson and Frank's work will be a stimu-

lus to encourage the study of this important element of the blood.

The effect of splenectomy in thrombocytolytic purpura is spectacular. Spontaneous hemorrhages ceased in our case at once. Others have reported immediate cessation of external hemorrhages. Recurrent bleeding rarely occurs. The blood picture changes almost immediately. Transfusion offers temporary relief in these cases.

I would like to call your attention to the reaction which followed within 3 hours of the splenectomy in our case. Suddenly the child became pale and showed a marked hyperpnea, with increased fremitus and rales over the entire chest. The skin was hot and dry and the temperature rose to 101.8 degrees and there was no restlessness. Nothing about the child suggested hemorrhage or shock. The patient had had only nitrous oxide and oxygen. It is impossible to believe that the reaction could have been a post-anesthetic pulmonary complication.

The similarity of the reaction to that of capillary poisons such as histamine forces one to the conclusion that this reaction must have been the result of an overdose of capillary poison suddenly liberated at the time of the splenectomy (cf Dale's work). Histamine produces a loss of capillary tone. In purpura hemorrhagica there is evidence of such a disturbing factor on the capillary tone the prolonged bleeding time.

I believe that one cannot escape the conclusion that the manipulation of the spleen probably liberated an excess of this capillary poison sufficient to produce the reaction.

Experimental work is contemplated with a view of determining the effect of splenectomy on experimentally produced purpura hemorrhagica.

#### CASE HISTORY

David Fischmann, age 5½ years. Patient gives no history of familial bleeding. He has had no infectious diseases except grippe. He has congenital club foot, for which he was operated upon at 4 months of age (Lorenz method) by Dr. Frauenthal, of New York, at 13 months by Dr. Jacobs, of Chicago. He was always a difficult child to feed and is nervous. Tonsillectomy by Dr. Haspel, in January 1923. He has improved greatly since.

Present illness. Patient was first seen about February 5, 1923 when few brownish and pur-

plash marks were noted on the lower arm and below the elbow, wrist, and legs, varying in size from a pea to a quarter. At first it was thought that they were bruises, though the child insisted that he had not fallen and that he had not hurt himself. Soon new spots were noticed before the child dreamed there having been no opportunity for injury.

He was first brought under observation because of a rather large ecchymotic area in the sacral region. Within a few hours this area increased in size. He was seen by Dr. J. N. Rossmel, dermatologist, who immediately diagnosed the condition as purpura. I saw him the same day. The next day he was seen by Dr. L. I. Lemann, who concurred in the diagnosis. He was kept under observation for a few days during which time he was given calcium lactate.

On March 8 several large purplish areas developed, one over the left iliac region and one large spot in the perineum. There was generalized spotting of the child's body. The new spots had a greenish hue and as time went on, there was brownish pigmentation of the periphery. Some of these areas had a doughy feeling.

There was generalized spotting of the body. Large areas were noted as follows:

The left forearm posterior surface, 4 centimeters; right forearm anterior surface, 3-4 centimeters; right hip external surface, 6 centimeters; sacral region (old), 4 centimeters; left hip external surface (dark blue), 6 centimeters.

Dr. Weiss was asked to see him in consultation prior to the first transfusion.

First transfusion, March 9, 93. Donor, father, type A, child, type B.

Three hundred and fifty cubic centimeters of citrated blood was given. The patient was allowed to go home the next day.

**Progress notes.** The spots began to fade rapidly and no new spots were noted until about March 3, when the father noticed several small brownish spots which Dr. Lemann and I both advised had best be observed before proceeding with the second transfusion. On April 3, a number of small purplish spots were noticed on the child by his father. On April 4, a second transfusion of 300 cubic centimeters of citrated blood was given. April 4. New spots appeared. A third transfusion of 50 cubic centimeters of citrated blood was given. The patient was kept under observation and given gelatine and calcium lactate but spots of this kind appeared several hemorrhagic areas were noted. He returned to the hospital for transfusion. Three hundred cubic centimeters of citrated blood was given.

On June 3, 93, the patient was admitted to the hospital for splenectomy. Operation was advised by Dr. I. I. Lemann.

Dr. Lemann's physical examination, June 3, 93, shows fairly well nourished, though slightly anemic child. There are a few pale brownish spots over the extremities. Near the left hip there is a large, faded, pigmented area of the original lesion which was noted at the first transfusion. The popliteal region equal and

react to light and accommodation. The teeth are good. The tonsil fossae are empty. The thorax is well formed and symmetrical. The lungs are normal. The heart is normal, apex impulse in fourth intercostal space within the nipple line. The abdomen is soft, flaccid with no tender areas. The spleen is not palpable, the liver is not palpable.

Blood examination shows: total white 6,500; total red, 3,780,000; hemoglobin, 55 per cent; color index, 74. No malaria plasmodia found. No red cell changes. Coagulation time 4 minutes. Bleeding time 5 minutes.

Differential count: small lymphocytes, 57; large lymphocytes, 3; neutrophils, 5; eosinophiles, 1.

X-ray examination of chest was made on the morning of June 4, to determine if there was any evidence of an enlarged thymus. Our radiologists reported that they found no evidence of an enlarged thymus.

March 8, 933. Coagulation time 3½ minutes. Blood count: total red cells, 3,760,000; total white cells, 7,500. Differential white cells: polynuclear leucocytes, 6; lymphocytes, 31; large mononuclear leucocytes, 5; eosinophiles, 2.

April 5, 933. Red count 4,820,000; white count, 6,000; differential polymorphonuclears, 46; large mononuclears, 5; eosinophiles.

Platelet count by smear only. Platelets were only occasionally noted on the blood smear. The count was not made because we had some difficulty in obtaining Cresyl Blue.

July 1, 933. Red count, 4,730,000; white count, 8,700; platelet count, 400,000.

July 5, 1933. Platelet count, 145,000; red blood count, 5,060,000; white blood count, 9,500; polynuclear leucocytes, 3; small mononuclear, 57; large mononuclear, 9; eosinophiles.

October 15, 933. Platelet count, 200,000. Record of perianth. Name, David Fischmann. Date of operation, June 6, 1933. Operator, Dr. Isidore Cohn. Assistants, Drs. Lacroix and Liles. Anesthetist, Dr. Cain. Anesthetic, nitrous oxide with oxygen. Pre-anesthetic hypodermic, Morphin 1/4 gr; atropine 1/300 gr at 7:30 a.m.

Anesthetic started, 8:10 a.m.; discontinued, 8:55 a.m. Operation started, 8:15 a.m.; discontinued, 8:55 a.m. Operation, Splenectomy.

Diagnosis, purpura hemorrhagica.

Postoperative diagnosis, purpura hemorrhagica. Operation, Bevan incision. Left Rectus muscle retracted outward, vessels in the linea transversae ligated before they were cut. Practically no bleeding was observed. The spleen presented some adhesions to the diaphragm. It was larger than normal, red, firm in consistency. A small accessory spleen was noted on the posterior aspect near the hilum. The gastrosplenic omentum was then clamped on both sides and ligated in sections. After the spleen was brought up into the wound, the space from which it was removed was filled with a large gauze pack. The spleen was then turned turtle and we found its pedicle. The pancreas was noted close to the

hilum of the spleen. Clamps and chromic gut ligatures were used on the pedicle. The pedicle was then cut and the spleen removed. The stomach and intestines were then dropped back. The large pack was removed. There was no bleeding and apparently very little raw surface. The peritoneum was closed with tier sutures.

**Progress notes.** Patient was returned from operating room 10 a. m. At 11:30 a. m. Respiration became very rapid, the child was pale, but not restless. Pulse rapid, marked fremitus and riles over the entire chest. Skin hot, dry. Patient was given morphine 1 gr hypodermically and quieted down. Pulse volume improved.

June 4, 1923 5 p. m. Numerous sonorous and subleant riles throughout both lungs and great bronchial fremitus corresponding to these. Patient is perfectly conscious and interested. He is willing and anxious to drink in spite of nausea and is somewhat pale. The surface is warm, and there is slight perspiration around the mouth. Respiration, while rapid, is quiet.

10 p. m. At 7 p. m. patient talked to random at times. Temperature had risen to 103 pulse good volume, though fast. Less bronchial fremitus and few riles. Abdomen distended. The condition of the patient is about the same as noted at 7 p. m. The patient has not been nauseated since 7 p. m. Sleeping quietly. Rectal temperature still 103. Pulse 40 respiration 3. No urine voided since operation.

3:30 a. m. Abdomen distended. Voided 3 ounces. Glycine enema given. Flatus expelled. Abdomen softer. Temperature lower. Patient resting.

4:30 a. m. Abdomen still slightly distended. Flushed face probably due to tropine. Pulse good volume, rapid. Mentally perfectly clear not anxious. Has not vomited. (Dr. Cohn.)

6:15 a. m. Catheterized, 6 ounces obtained sent to laboratory. Abdomen soft since flush and catheterization. Fecal matter and flatus obtained. Pulse, good volume. Temperature 101.8 pulse 58 respiration 34 at 4:30 a. m. Respiration regular not deep.

June 5, 1923 8:30 a. m. Color good quiet but alert when awake. Sleeping quietly. Few riles in left lung anteriorly. Dullness over left lung to base posteriorly.

5 p. m. Quiet day sleeping most of the time. Rational when awake. Morphine grains 1/8 at 2 a. m. /24 at 3 p. m. Color good, skin moist. Pulse the same as this morning. Respiration deep and rapid. Has voided no urine. No riles heard in front of chest. None posteriorly. Dullness to right base not great. Voided 8 ounces at 7 p. m. Abdomen soft. Good results have been obtained from flush. Has retained most of the fluids taken.

June 6, 1923 Good night. Slept quietly except when disturbed. When awake he is quite clear and interested. Pulse good volume. Respiration deep, rapid. Color rosy no evidence of fatigue. Much flatus and plenty of fecal matter per flush. Urine

3 ounces during night. Hypothermoclism 100 cubic centimeters. Vomited several times, immediately after drinking, usually after taking medicine. Most of the fluids taken by mouth. Slight dullness, bronchial breathing, right lung posteriorly.

June 7 1923 9 a. m. Has had good night. Abdomen not distended. Pulse slower and of great volume. No riles in chest. Harsh breathing and prolonged expiration left lung posteriorly. Nausea.

5:30 p. m. Voided 18 ounces since 7 a. m. Nausea not vomiting. Abdomen not distended. Flatus by flush. Pulse good volume, average rate 90. Color good, expression normal. Interest in environment.

June 8 9:30 Good night. Voided 20 ounces during night. Took 25 ounces during night. Bowels acted well with flush. Riles in right axillary line. Abdomen soft. General appearance improved. Purpuric spots fading. N. new spots. Flatus, reading. Dullness in right base no riles. 3 p. m. Voided 3 ounces since 7 a. m. Abdomen soft, taking nourishment freely.

June 9, 1923 Voided 4 ounces during night. Abdomen soft. Interested in stories, wants to be read to continuously. Acting as he does normally.

June 11 1923 Dullness right base with diminished respiratory sounds has continued. N. riles. Except for rapid respiration and the slight elevation of temperature he seems to be normal.

X-ray report. Radiographic examination of the chest shows evidence of pneumonia of the right side, extending from the region of the scapula to the base. The diaphragm is raised about one-half inch.

June 12 9:30 The physical signs in the right base has continued about the same. This morning the dullness is little less and the respiratory sounds more easily heard when the patient lies on the right side. When the right side is uppermost the respiratory sounds are still distant and vague. N. riles. The child is perfectly alert except for the rapid respiration which is now 30 per minute. No purpuric spots have appeared since operation and all old ones have faded out.

June 4, 1923 Wound dressed, sutures removed, wound healed by primary intention. Abdomen soft no tender areas no purpuric spots noted. Examination of chest by Dr. Lemann. Remained in bed because of hyperpnea. From the time of the operation to the present time we have noted an occasional brownish spot which was not prominent and not characterized by coming groups, and his general health has improved. Patient as sent to the Gulf coast for about 6 weeks where he was encouraged to stay out in the open with as few clothes as possible. The object of this was to obtain full benefit from the sunlight stimulation of the bone marrow. He has gained in weight.

October 9 9:30 No recurrences to date, appetite good. He has gained in weight.

December 3 9:30 Gaining weight steadily. No recurrences.

**Laboratory findings.** Spleen measures 2 by 6½ by 4 centimeters and weighs 100 grams. Dark red color somewhat pulpy in consistency but having a leathery feeling. Cut surface somewhat resistant to the knife. Presents a granular appearance. Pulp comes off rather poorly. There are no other characteristic findings.

There is also an accessory spleen adherent to the fascia and capsular tissue of the normal organ. It is spherical in shape, dark red in color, pulpy in consistency and measures ¼ centum cent in diameter. Not sectioned. **Diagnosis.** Lymph follicles prominent. Sinusoids more prominent than normal with some increase of connective tissue. Sigurd, John A. Lanford, M. D.

I cannot conclude this paper without expressing my appreciation of the co-operation of Drs. Williamson and Liles during the time that the child was at the hospital. The former on duty in this case. Miss Maybry and Lind say down special mention for their work. Miss Marshall Liberman of the Orleans Parish Medical Society has been helpful in preparing bibliographies, and in obtaining the literature from the Surgeon General Office. I am indebted to Doctors Loria, Lacroix, Lobenhoffer, Lemann and Goorvick, and Miss Ambrose for translations. I am particularly indebted to M. Fichmann, the father of the child, for a very good translation of Hamelton's article and to Dr. on Meyersburg for his kind co-operation in the platelet counting.

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## ABSCESS OF THE LIVER DUE TO BACILLUS AEROGENES CAPSULATUS

BY CRAYTON C. SNYDER, M.D., F.A.C.S., PASADENA, CALIFORNIA

EVER since the bacillus aerogenes capsulatus was isolated and described by Welch in 1892 medical literature has contained a constantly increasing number of reports concerning the lesions produced by this organism. Yet in all this mass of material there are few accounts of liver abscess in which this bacillus had been indubitably established as the causal organism. The paucity of data concerning this particular expression of pathological activity on the part of this bacillus is the more surprising, because it was very early established that "the liver is the organ most frequently the seat of early and abundant development of gas" in cases of general emphysema. Welch regards the intestine as by far the commonest source of the gas bacilli found together with gas bubbles in the blood and organs at autopsies. Especially demonstrative of invasion of gas bacilli from the intestine usually postmortem is the occurrence of gas bubbles limited to the neighborhood of the intestine as in the intestinal wall within the portal or mesenteric veins or lymphatics, in the subperitoneal tissues, mesentery and omenta, around the pancreas, in the mesenteric gland and especially in the loose tissue near the gall bladder and in the porta of the liver without gas in more remote situations.

The development of gas in the liver is so striking a phenomenon in most autopsies where the gas bacillus and free gas are found in the blood and organs that P. Ernst used the term *Schaumleber* (foamy liver) for the title of his article on the gas bacillus published the year following that of Welch and Nuttall in which these authors had directed attention to the subject of foamy organs. In cases of foamy liver Welch found gas in the bile ducts and gall bladder but it was his experience that when the gas bacilli reached the liver through the blood vessels the appearance of the gas in those situations was of late occurrence and encountered chiefly

in advanced cases. In contrast to these cases are the observations of gas in the biliary passages, associated sometimes with definite lesions of the bile duct and liver where the evidence was that the gas bacilli entered from the intestine directly into these passages.

In the case which I am about to report, as well as in most of those which I have been able to collect from the literature, the liver abscess was associated with cholecystitis and other gall bladder pathology which confirm the original observations made by Welch a quarter century ago.

The earliest record I have been able to locate of liver abscess due to the presence of gas bacillus is that reported by Nicholls from Adams's clinic at the Royal Victoria Hospital, Montreal. On February 15, 1896, cholecystectomy and removal of gall stones was done upon a woman of 55 and the fistula gradually closing cholecystenterostomy and the insertion of a Murphy button took place 4 months later. Death occurred 4 days after the second intervention. At autopsy it was reported that multiple millary abscesses chiefly confined to the lower half of the right lobe were found in the liver. "On pressure the blood exuded contains gas and coverall preparation demonstrated a bacillus resembling bacillus aerogenes capsulatus. Cultures from all the viscera gave the bacillus aerogenes capsulatus. The reporter remarks:

In this case the infection was apparently from the intestine into the gall bladder and then into the liver and other viscera and that it was no doubt, a postmortem event. In my opinion it is an antemortem event.

The second case was also reported on this continent, being presented before the New York Pathological Society in January, 1898, by John H. Larkin. No definite diagnosis had been made during life but at autopsy the gall bladder was moderately distended with thin yellow bile and contained about a dozen small gall stones and three more small

stones were lodged in the papilla, at the opening of the common bile duct. The liver was slightly enlarged and in its tissues were a number of small circumscribed necrotic areas, containing what looked like pus." On microscopic examination many areas of focal necrosis were seen scattered in the liver parenchyma. In some sections there were irregularly shaped air-holes with "flattened necrotic and non-nucleated cells making up their border. The constant presence of bacteria at their periphery and of swarming masses of bacterial emboli in the capillaries and central veins must not be lost sight of. In other sections, the principal lesion is abscess formation, both of the millary and large variety. In all the tissues examined a bacillus was found which stained quite readily with Gram's, Weigert's and Loeffler's method. The bacilli were in clumps and clusters in the capillaries and blood vessels and the centers of necrotic foci.

The bacillus *aerogenes capsulatus* was isolated in pure culture also another morphologically similar to bacillus coli communis.

A case of carcinoma of the common bile duct complicated by multiple abscesses of the liver from which bacillus *aerogenes capsulatus* was isolated was reported by Pratt and Fulton in 1900. A diagnosis of obstruction of the common duct had been made upon a man of 63 years. At operation the gall bladder was found considerably distended with bile and surrounded by adhesions, but the obstruction was not located. Four days after operation, vomiting set in attended by epigastric pain which continued until death which took place on the seventh day. Autopsy revealed carcinoma of the common bile duct with involvement of adjacent tissues, and multiple abscesses of the liver. Scattered over the surface of this organ were numerous small whitish areas, the largest measuring

by 4 millimeters, which when cut exuded a grayish white purulent material, a smear from which showed many pus cells and numerous large bacilli, with rounded ends staining by Gram method. On section these areas are seen in considerable numbers throughout the liver. The walls of the abscesses were fairly well defined and had a

greenish translucent appearance. Microscopically the walls proved to be composed of connective tissue, containing a few liver cells, and infiltrated with leucocytes and many eosinophiles. A beginning of abscess formation was demonstrable at the bile ducts and it seemed probable that the infection had entered by way of the bile passages. No bacteria were found other than those morphologically and in staining reaction like the gas bacillus. These bacteria were located in the bile ducts as well as in the abscesses.

In the year 1907 two French scientists experimentally produced abscess of the liver and cholecystitis in rabbits by the intra-venous injection of bacillus *aerogenes capsulatus* in pure culture. In their first experiment one out of three rabbits inoculated developed numerous small hepatic abscesses, the contents of which on culture yielded a pure strain of the inoculated organism. In their second experiment autopsy upon the single animal inoculated showed the liver the transverse colon and the right kidney surrounded by a whitish membrane tough and thick but easily detached from the organs. The origin of this peritonitis appeared to be an abscess in the right lobe of the liver surrounded by several other (smaller) abscesses. These foci contained a purulent liquid which yielded a pure culture of bacillus *aerogenes capsulatus* (designated by the Frenchmen as *perfringens*). It was noticeable that there was no gas production.

These experiments demonstrated that anaerobic bacteria may be carried by the blood stream so as to produce not only hepatic abscess, but cholecystitis as well the abscess thus produced having the character peculiar to lesions due to anaerobic bacteria.

Several clinical cases were very shortly thereafter published in France. Le Dentu reported to the French Academy of Medicine a case which he had operated on in 1907 and recalled another which he had seen previously but of which he gave no details. The reported case was that of an officer of colonial troops 39 years old who suffered from malaria in 1905 and the next year presented symptoms of hepatic abscess. Coming under the care of Couteaud this physician made

several exploratory punctures with negative results. Finally low down in the eleventh intercostal space the trocar seemed to penetrate a cavity and the insertion of a bistoury produced a few drops of pus. Enlargement of the incision resulted in the evacuation of perhaps 600 cubic centimeters of thick white pus mixed with gas. The edges of the enlarged wound were approximated with catgut and two large drains inserted. Complete recovery followed within a month.

Couteau thought the gaseous content of the abscess was due to the passage of air through a hepatobronchial fistula, but the reporter of the case believed that it could have been produced only by the presence of anaerobic bacteria. He says that staphylococci and other bacteria were recognized in the pus but no specific mention is made of *Bacillus aerogenes capsulatus* or *perfringens*.

In our own country in 1914 A. H. Baugher in a paper concerning the recovery of *Bacillus aerogenes capsulatus* from blood cultures, related the case of a man of 51 who following an attack of cramp-like pains in the gall bladder region was under hospital observation for a week. During the observation period a blood culture was made which yielded *Bacillus aerogenes capsulatus* and *Bacillus mucosus capsulatus*. Operation 5 days thereafter revealed a ruptured gall bladder, a large abscess beneath the liver containing thick yellowish, bile stained pus and two pea-sized gall stones. The pus had a very foul odor and smears revealed the same organisms as were found in the blood and in addition a small Gram negative bacillus, a fusiform bacillus and cocci.

The patient recovered. To prove the identity of the bacillus rabbits were injected in the ear vein with 3 cubic centimeters of the blood culture medium and killed in a few hours. The autopsy findings were typical of those due to *Bacillus aerogenes capsulatus* after 18 hours incubation. Smears from the various organs and heart's blood demonstrated that the bacillus was encapsulated as did also the smears from the original pus.

Four cases of hepatic abscess in which *Bacillus aerogenes capsulatus* was present have been reported from Germany. To one

of these accounts, that of Lenk, published in 1917 I have been unable to gain access. The abscess is mentioned by Massari as following a shell wound and appears to have been fatal.

The cases of gas-containing liver abscess were diagnosed clinically and roentgenologically by P. Schenk, only one of which is reported in detail. The patient 37 years old suffered a sudden onset of diarrhoea and visual disturbance followed by severe chills apparently as the result of eating spoiled meat. Pleural effusion appeared and exploratory puncture at the eighth intercostal space produced a chocolate-colored foul-smelling pus containing liver cells which showed fatty degeneration. Roentgenologic examination of the liver revealed fluid and light areas about the size of an apple. At operation a large hepatic abscess filled with gas bubbles was found. The patient succumbed and at necropsy other abscesses were discovered in the brain and lungs. The mode of entrance of the gas-forming bacilli was not determined.

Massari later in the same year reported another case prefacing his account with the statement that but six such cases were to be found in literature. A careful examination of his references proves that three of them refer to the same case—that of Couteau reported by Le Dentu, and another—that of Dévé and Griesinger concerns hydatid cysts of the liver in which there was gas formation. He ignores entirely all English and American work on the subject.

Massari's patient was a laborer age 52 whose right arm was mutilated by machinery. When the arm was amputated 54 hours after the accident it was affected with gaseous gangrene but without typical gas phlegmon formation. On the sixteenth and seventeenth postoperative days symptoms of the formation of a gas-containing abscess were in evidence probably hepatic rather than subphrenic. Operation disclosed a large liver abscess from which a liter of gas-containing fluid was evacuated. The surgical wound was closed with drainage and healing was accomplished in 12 days. The portion of liver affected was found to have been injured in the accident so the gas-producing anaerobe probably gained access through this trauma.



My own case clinically somewhat resembles those first reported but as the final outcome was more fortunate it may be more justly compared with that of Baugher.

The patient a retired physician of 68, had previously enjoyed excellent health, except for what he termed digestive "upsets." Two years ago in June, 1920, he suffered a sudden attack of gall stone colic, which lasted about 4 hours, the pain being relieved spontaneously before he received medical attention. For several weeks subsequent to this attack the skin was slightly icteric and the digestive functions disordered: there was vertigo and occasionally nausea and vomiting. I first saw the patient in June, 1922, at which time another attack began and was associated with chills, fever and pain in the lower extremities.

About 8:30 a. m. there was a severe chill, lasting nearly an hour accompanied by acute cramping pain in the hips and legs, and followed by fever and sweating. The afternoon of the same day there was

second chill, followed by a temperature rise to 104 degrees F. The next day at 2 and 4 p. m., there were further chills with pyrexia, but the following morning the temperature was normal. Two more chills occurred that day at 2 and 3 p. m. with subsequent fever and profuse perspiration.

The patient was decidedly obese, weighing 40 pounds. Physical examination showed temperature of 104 degrees, respiration 36 somewhat labored, pulse 120 regular but weak in character and blood pressure systolic 150 diastolic 95. There were several decayed and suspicious looking teeth, but throat was negative. Examination of the chest revealed myocarditis. The abdomen was distended and tense, with marked tenderness and rigidity below the right costal margin but no masses could be palpated.

The urine contained a trace of albumin, numerous hyaline casts, many pus cells, indican, and bil. The blood count gave red cells and platelets normal, white cells 10,500, polymorphonuclears 84, lymphocytes 15, and mononuclears and transitional 0.

A diagnosis of acute cholecystitis with cholelithiasis was made and operation undertaken on June 4, 1922, under gas oxygen anesthesia.

The abdomen was opened by the usual incision for gall bladder exploration revealing free pus issuing from perforation in the gall bladder inch from the fundus, and an abscess the size of a hen egg at the junction of the cystic and common duct. A quantity of pus and several stones were found in the gall bladder to which the great omentum was adherent. Upon the under surface of the right lobe of the liver near the anterior margin, was a mass as large as an ordinary sized lemon. A rubber tube was inserted and fixed in the gall bladder, a Penrose drain was inserted into the abscess at the junction of the cystic and common duct, an aspirating

needle inserted into the liver abscess and a quantity of pus removed for bacteriological examination.

The specimen was given for examination to Dr. Moody, pathologist at the Pasadena Hospital. He later reported that a pure culture of bacillus aerogenes capsulatus was present, while cultures made from the gall bladder and the cystic and common duct abscess revealed the presence of mixed infection. An incision was made into the liver abscess and a rubber tube introduced and secured in position. The abdominal wall was closed in the usual manner.

The patient was given 2000 cubic centimeters of salt solution subcutaneously and a gastric lavage done while he was on the table.

*Postoperative treatment.* The patient did not vomit following the operation. One thousand cubic centimeters of salt solution was given subcutaneously daily for 7 days, also an equal amount of salt solution by proctoclysis. Digitalis minims 15 per hypo was given every 6 hours for the first 4 days for the patient's myocardial condition. The wound discharged a large quantity of foul smelling pus for 6 days. The liver abscess was irrigated through the drainage tube 4 times daily with Dakin's solution.

One noticeable feature was the very extensive sloughing of fascia. On one occasion a piece of fascia 4 inches in length and 3/4 inch wide was removed intact.

The Penrose drain was removed on the fifth day the tube from the gall bladder on the tenth day, while the tube in the liver abscess was not removed until the seventeenth day.

Another noticeable feature in connection with the wound was extreme sloughing of muscle and fatty tissue. During this period of repair it looked as if ventral hernia would surely result. However after several weeks the wound closed nobly with out herniation.

A smear made from the wound on October 20, 1922, revealed the presence of staphylococci and pyogenic organisms, but no bacillus aerogenes capsulatus. A Wassermann test made 6 days thereafter was negative. The patient is at present enjoying good health, considering his 69 years.

Patient's health as good following recovery from operation until November, 1923, at which time symptoms of malignancy appeared and continued until death, January 8, 1924, 9 months after operation.

*Autopsy findings.* Dr. T. B. Cook, age, 70 years. Death occurred January 10, 1924. Autopsy held, 5:30 p. m. J. Warr, 1924, at Turner and Stevens. Attending physician, Dr. C. C. Snyder. Clinical diagnosis, carcinoma of liver.

*Anatomical diagnosis.* Primary carcinoma of the gall bladder with secondary growths in the liver, the peritoneum, retroperitoneal lymph nodes, and meso- and meso- of the hepatic flexure of the colon. emaciation, petechial hemorrhages disseminated throughout the skin and the anterior surface of the arms and the

trunk, edema of both lower extremities healed operative incised scar in the right upper quadrant of the abdomen chronic diffuse nephritis icterus

**Histological examination of tumor masses.** The tumor growth consists of low columnar and epithelial cells arranged in columns and masses and in some places, papillary, containing many atypical mitoses, possessing the characteristics of a rapidly growing tumor. There are many areas in sections of the tumor masses of the liver which contain a considerable amount of necrosis.

**Diagnosis.** Adenocarcinoma

#### CONCLUSIONS

1 Infection apparently is due to invasion from the intestinal tract where gall bladder tissue is already lowered in resistance from previous infections

2 Acuteness of symptoms and rapid development of pathology follow invasion of bacillus aerogenes capsulatus

3 Extensive sloughing of fascia and other soft tissues is found

4 Occasionally patients suffering from this type of infection recover

I am indebted to my associates, Dr A T Newcomb and Dr M G Varian for their able assistance in the management of this case

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MULTIPLE POLYPOSIS OF THE GASTRO-INTESTINAL TRACT<sup>1</sup>

II JOHN F. STRUTHERS, M.D., F.A.C.S., ROBERT H. B. MAYO, M.D.

Fellow in Surgery

**M**ULTIPLE polyposis of the gastro-intestinal tract is not as uncommon as was formerly believed and recently the number of correctly diagnosed cases has been augmented by means of the roentgen ray. Patients who are not willing to submit to operation for an indefinite condition will submit to a roentgen ray examination and cases of multiple polyposis of the intestinal tract are now correctly diagnosed before operation or death. Twenty-four cases have been observed at the Mayo Clinic since February 1920 20 of which are reported here.

## REVIEW OF LITERATURE

The earliest case reported in literature was probably that of Menzel in 1721 which was quoted by Hewitt and Howard. A review of 71 cases from the literature was given in my previous paper; further search has brought to light 13 additional cases. Warwick reported 2 cases, both discovered at necropsy. Each of the following report 1 case: Wegele, Mill, Melphedran, Cope, Rosenberger, Carnot, Friedel and Troussard, Mueller, Lockhart, Mumery, Bland, Sutton, Myer and Hansen. The case of Cope and the one of Warwick had multiple polyp in the small intestines. Eight of the 13 cases occurred in males and 5 in females. The average age of the males was 37 years and of the females 40. The oldest and youngest patients were both males, aged 60 and 16 years respectively. In three instances positive diagnosis was made by means of the roentgen ray. In two instances patients passed polyp during the course of gastric lavage. One of these patients also passed a polyp by bowel following a hemorrhage (25, 36).

The case reported by Cope was interesting (1) because the polyp occurred in the middle portion of the small intestines. Papillomata in this location are very rare. King, in reporting 119 cases of benign tumors of the small and large intestines, does not report one case of papilloma. And (2) because intussusception of

the middle portion of the small intestine is exceedingly rare. Nevertheless, intussusception occurred in this case three times. Cope was misled in this case believing the papilloma to be in placated bowel contents and in the first instance after reducing the intussusception, the wound was closed. In two succeeding operations the true nature of the tumors was discovered and the papillomata were removed. Five operations were performed in this case and the seriousness of the presence of tumors of the small intestines is indicated by the repeated obstruction due to intussusception.

From the roentgenological operative and necropsy findings in the cases reported in the literature it was learned that the various portions of the gastro-intestinal tract were involved as follows:

	Cases
Stomach	4
Cecum to the rectum	3
Rectum and sigmoid	
Hepatic flexure and small intestines	
Small intestines	
Transverse colon, splenic flexure and descending colon	
Descending colon and rectum	

In one case there was an ulcerating mass at the recto-sigmoid juncture above and below which were multiple polyp but especially above. Metastatic carcinoma was present in the liver, spleen, kidney and abdominal lymph nodes. Eight of these cases were designated polyp, two papilloma, one adenomatous polyp and one adenocarcinoma. However, in only 3 of the 8 cases diagnosed polyp was a microscopic examination made and hence their true type is not known. The predominant symptoms were gastric in 4 cases, diarrhea with pus and blood in 5, bleeding associated with prolapse in 1 case, repeated attacks of obstruction in 1, dull abdominal pain with localization in the right side of the abdomen in 1, and in 1 case no symptoms were given. Nine of the patients were treated surgically. In certain instances palliative operations were performed to re-

<sup>1</sup>Abstracts of theses submitted to the Faculty of the University of Minnesota in partial fulfillment of requirements for the degree of Master of Science. Surgery, May 1923.

lieve the symptoms, but not to eradicate the disease. Two patients were treated medically and one refused treatment. Six of the patients operated on were reported to be living but none longer than 2 years after operation. The most favorable prognosis seems to be in the cases in which radical surgical measures were undertaken to eliminate the disease (23). One of the patients treated medically is reported to be cured although bits of polyps are still present.

One of the patients in whom multiple polyps was found at necropsy had had chronic diarrhea followed by rectal hemorrhage. In Hansen's patient polyposis was also discovered at necropsy. She had had bloody diarrhea for 1 year with slight gnawing pains in the region of the transverse colon. The hemoglobin was 10 per cent, the erythrocytes numbered 1,500,000 and the leucocytes 6,900. Two stool tests were negative.

#### TWENTY CASES OBSERVED AT THE MAYO CLINIC BETWEEN FEBRUARY 1, 1920 AND JANUARY 1, 1923

*Age and sex.* Four patients were between 17 and 30 years of age; 1 was aged 63; 8 were between 41 and 50; 2 were between 51 and 60; 3 between 61 and 68; and 2 between 69 and 75 years. Ten of the patients were men and ten were women.

*Duration of symptoms.* Seven patients had had symptoms lasting less than 1 year; 6 from 1 to 2 years; 1 3 years; 4 from 5 to 6 years; 1 7 years, and 1 9 years. The shortest duration was 4 weeks; the longest 9 years.

*Type of onset.* Three patients had had mild diarrhea followed by pus and blood; 2 had general abdominal distress of these 1 had nausea and vomiting; 3 had diarrhea of sudden onset, with pus and blood; 1 with constipation and diarrhea alternating; 4 were constipated; 1 with marked bleeding following the use of a laxative; 1 bled from the rectum; 2 had marked abdominal colics with sudden diarrhea; 3 had rectal pain with diarrhea; 1 with bleeding alternating with diarrhea; and 2 had mild symptomless diarrhea.

Twelve of the 20 patients had had diarrhea early; 7 had been constipated; 2 of these had had intermittent diarrhea, each succeeding

attack of diarrhea being more severe and of longer duration than the preceding one; 2 of these had periods of diarrhea later. The patient with gastric polyposis had had increasing constipation for 2 weeks.

Seventeen of the 20 patients had had rectal symptoms early. One was unable to control the bowels; one had marked hemorrhage from the rectum; the amount of bleeding in the other patients was variable.

Two of the patients came to the Clinic because their home physician had found a mass in the abdomen. One of these had consulted his physician because of chronic diarrhea and the other because of constipation growing progressively worse. Only 1 patient came to the Clinic because of pain; this was the patient with gastric polyposis. However the whole lower abdomen of 3 patients was painful and tender to pressure. Five patients had pain in the left lower quadrant, and 1 in the right lower quadrant; diarrhea and constipation if most marked aggravated the pain. One patient with constipation was also unable to void and had severe pain over the bladder. As the constipation increased the bladder pain also became worse. At operation a perforating carcinoma of the upper rectum firmly fixed to the pelvic wall and pressing on the ureter was found, which probably accounted for the pain in the bladder. Two of the patients with pain in the lower abdomen had had nausea and vomiting with their early spells of diarrhea.

*Complaint on admission to Clinic.* Ten of the 20 patients complained of diarrhea with pus and blood; 1 of them, of gas from the penis; 3 of rectal pain and marked constipation; 1 of hemorrhoids; 1 of constipation and the passage of blood; 2 of a mass in the abdomen; 1 with diarrhea; and 1 with constipation; 1 of bleeding from the rectum; 1 of epigastric pain; and 1 of inability to void and bleeding from the rectum.

*Loss of weight.* The loss of weight varied markedly with the severity of the disease, ranging from 15 to 60 pounds. One patient with a mild constant diarrhea gained weight, although less than 10 pounds.

*Blood.* The duration of the disease and the degree of bleeding have a marked effect on

TABLE 1.—DATA CONCERNING FOURTEEN CASES OF MULTIPLE POLYPOIDS OF THE GASTROINTESTINAL TRACT TREATED SURGICALLY

## P E T T I L I N I

Case	Age and sex	Diagnosis	Operation	Data from history
Case 1	34 M	Mucous polyp in duodenum	Polypectomy and ileocecectomy	1. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 2	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	2. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 3	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	3. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 4	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	4. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 5	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	5. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 6	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	6. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 7	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	7. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 8	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	8. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 9	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	9. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 10	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	10. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 11	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	11. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 12	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	12. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 13	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	13. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 14	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	14. pain by exertion on duodenum, typical for ulcer or cancer. No other data.

## M E T T I N I

Case	Age and sex	Diagnosis	Operation	Data from history
Case 15	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	15. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 16	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	16. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 17	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	17. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 18	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	18. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 19	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	19. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 20	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	20. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 21	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	21. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 22	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	22. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 23	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	23. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 24	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	24. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 25	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	25. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 26	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	26. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 27	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	27. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 28	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	28. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 29	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	29. pain by exertion on duodenum, typical for ulcer or cancer. No other data.
Case 30	34 M	1. Polypoidal polypoid	Polypectomy and ileocecectomy	30. pain by exertion on duodenum, typical for ulcer or cancer. No other data.

TABLE II—DATA CONCERNING SIX CASES OF MULTIPLE POLYPOSIS OF THE GASTRO-INTESTINAL TRACT IN WHICH OPERATION WAS NOT PERFORMED

Date of report	Case number	Age and sex	Diagnosis	Condition of bowels during past six months	Rectal pain	Abdominal pain	Proctoscopic examination	Macroscopic findings	Advice to patient	Last report on condition
8-3-21	(Unreported)	F	Multiple polyposis anorexia	Stool darkish, red and blood	With stool	None	Multiple polyposis of the rectum and sigmoid, all away (all the polyps scattered throughout rectum and sigmoid) Excised 44 cm	Neurological examination negative. Wassermann negative	Because of anorexia, weakness, and also late refusal to co-operate, advised to return home	
10-21	(Unreported)	16 M	Chronic ulcerative colitis with multiple polyps	Frequent jelly like stools to 16 times a day. Intermittent constipation. Bloody	With stool	Increased peristalsis. Pain at lower abdomen	Reduced anal sphincter. Rectal mucosa membranous defect at sphincter. Superficial ulceration. Bleeds easily. Multiple small polyps. At 4 cm. mucosa membranous covered with mucopurulent discharge	Roentgenogram of colon revealed irregular filling defect at splenic flexure without obstruction	Readily advised of above. Rectal treatment after period of therapy, advised to return home	
3	(Unreported)	17 F	Localized ulcerated polyposis	Intermittent constipation with blood, no getting worse	No pain	No pain	Mass of localized polyposis on right sigmoid-ileocolic wall. No other abnormality. Mucosa healthy. Potentially malignant	Roentgenogram of colon revealed spastic filling defect. I also had report of specimen adenomatous polyp	Exploration and excision of specimen. Refused operation	Condition unchanged
6-26-21	(Unreported)	18 F	Multiple polyposis of colon with stricture. Mucosa at anastomosis and ectopic	Discharge pus and blood	Right	Crimp-like pain in upper abdomen with occasional nausea and vomiting	Polyps varied from .5 to 3 cm. as far as could be seen. Superficial ulceration, mucosa membranous. Mucosa of some polyps	Roentgenogram revealed stricture and filling defect of sigmoid colon. Chast. 75 high tree. No anastomosis present. Pus and red blood cells	Patient advised to return home	Died 24-22
8-5-21	(Unreported)	20 M	Carcinoma of recto sigmoid with multiple polyps with adenomatous degeneration	Constipation, with blood in stool	Right	Upper abdominal pain, severe localized local tenderness	At 4 cm. a large bleeding polyp more underlying degeneration. One third below identified. Polyp 2 cm. to 3 cm. in size	Colon very high tree. Blood negative	Giant polyp containing carcinoma, found in situ. Palliative. Age of patient 4, carcinoma indicated more	21, rapidly failing
4-4-20	(Unreported)	17 M	Chronic ulcerative colitis with polyps and ulcerations	Discharge pus, feces of sphincter control	Right	None	Ulcerative colitis with proctitis and multiple polyps to 30 cm. Ulcerative proctitis in anal canal at anastomosis. Colitis covered with pseudomembrane. Mucosa negative for parasites	Roentgenogram revealed diverticulae of sigmoid and narrowing of rectum	Sent home on Diet moist	21-22, diarrhea, some improvement, still losing weight

the degree of anemia. One patient (Case 4) had haemoglobin 35 per cent erythrocytes 2,910,000 leucocytes 7,300, and color index 0.6. This patient was found to be in Group II. She was given two transfusions of 500 cubic centimeters of blood each by the sodium citrate method. Four weeks later the haemo-

globin was 70 per cent the erythrocytes numbered 4,003,000 the leucocytes 14,400 and the color index 0.71. The lowest erythrocyte count was 2,910,000 the lowest leucocyte count 3,000 and the highest leucocyte count 23,400. No patient presented eosinophilia. Six patients had a haemoglobin between 79



Fig. Small portion of mucosa secreting adenomatous polypus. Goblet cells are prominent. This is similar to the stomach polypus, though the cells are larger and the glands more characteristic of rectal mucosa. (Case A99399) (X 50)

and 70 per cent 11 between 60 and 60 per cent 2 between 49 and 40 per cent and 1 35 per cent.

**Examination of stools.** Only 9 patients had stool tests. The stools were reported negative for parasites, but contained pus and blood in six instances, were negative for parasites, pus and blood in two, and the *extrema histolytica* was found in one.

**Proctoscopic examination.** Seventeen patients were proctoscoped. Multiple polyps of the rectum and sigmoid were found in 5, chronic ulcerative colitis with multiple polypi, in 4, multiple polyps of the rectum, in 6 (one marked ulceration limited to the lower 12.5 centimeters of the rectum) and chronic ulcerative colitis in 2.

**Diagnosis.** Sixteen patients had multiple polyps. 6 of these also had chronic ulcerative colitis. 1 had gastric polyps, as shown in the roentgenograms. Eight specimens were removed on proctoscopic examination. Three were diagnosed as adenoma (one inflammatory) two as adenocarcinoma, and one as a carcinomatous polypus. In one instance two specimens were removed from the same patient, one of which was diagnosed as adenocarcinoma, and the other as adenomatous polypus.

**Operations.** Fourteen patients were operated on. 4 had second operations (Table I).

Three patients had disease of the rectum. 6 of the rectum and sigmoid. 1 of the rectum and transverse colon. 1 of the hepatic flexure, transverse and ascending colon. 2 of the stomach, and in 1 the polypi extended from the ileocecal valve into the transverse colon.

**Pathologic report on specimens removed at operation.** Specimens from the sigmoid and upper rectum were diagnosed as adenomatous polypus, adenomatous polypus with carcinomatous ulcer and papillary adenoma from the rectum as adenomatous polypi very inflammatory papillary adenoma, and carcinomatous polyps, low grade malignancy from the hepatic flexure, transverse and ascending colon as adenomatous polypus. In the case of gastric polyps, the tissue removed from near the pylorus at the first operation was reported as inflammatory, the specimen removed at the second operation, from the distal half of the lesser curvature, revealed extensive multiple polypoid carcinoma. The patient with the perforating carcinoma of the rectosigmoid had many polypi below the growth.

**Roentgenologic examination.** Sixteen patients in the series were examined roentgenologically. Five had lesions of the rectosigmoid: 2 chronic ulcerative colitis, 2 multiple diverticulitis of the sigmoid and descending colon, with a filling defect in the sigmoid flexure, 1 gastric polyps, 1 gastrojejunal ulcer and 1 intestinal stasis with obstruction. Roentgenogram of the colon of 4 was negative. One patient had been examined by the roentgen ray elsewhere and the obstruction at the rectosigmoid was revealed. The condition of this patient did not warrant a second roentgen ray examination here. At operation multiple adenomatous polypi with ulceration were found.

The findings in this series of cases confirm my previous observations that multiple polyps, whether in the stomach, colon or rectum, is a diffuse condition.

**Positive Wassermann reactions** were not obtained. One patient gave a family history of cancer, the paternal grandfather having had cancer of the stomach. Four had marked pyorrhea. Tuberculosis was a negligible factor (one patient had inactive pulmonary

tuberculosis) Two patients had neurosis one, of the menopause type

One group of 4 patients not included in the series of 20, seem worthy of brief consideration here because their ages do not coincide with the congenital theory The youngest was 45 years old and the average duration of symptoms was 8 years Two were men and two were women Two complained of hæmorrhoids, and two of chronic constipation with pain and bleeding after stools Three were examined with the proctoscope and multiple rectal polypi were found in each One patient refused proctoscopic examination but on digital examination, one large and many small polypa were felt In three instances the polypi were removed by clamp and cautery and in one by incision and suture The specimens removed were simple polypi in three cases and adenomatous polypus in one The hæmoglobin was between 70 and 70 per cent in 3 cases, and between 69 and 60 in 1 The 4 patients replied to questionnaires all are free from their rectal complaints, at least 1 year after operation The point of interest concerning these cases is whether the condition will recur and if so whether it will be higher in the rectum, and malignant Fink believes multiple polypa begin in the rectum and multiply upward (32) If early eradication of the growth prevents multiplication and extension upward then early operation is certainly indicated if for this reason alone The tendency of such polypi to become malignant is well known Mummery said Almost all recorded cases of multiple polypi of the colon eventually become malignant, and this is the factor to be reckoned with in treating these cases When multiple polypa are diagnosed their radical removal should be recommended

*Patients not operated on* Six patients of the series were not operated on Two refused operation, 3 were hopeless surgical risks, and 1 highly neurotic patient refused to co-operate in any way (Table II)

The histories of Cases 3 and 12 are given in detail in Case 3 because the positive roentgenologic diagnosis was confirmed by operation and the patient was treated by high voltage roentgen ray and re-rayed after a series of treatments in Case 12 because it carried two



Fig. Section of stomach showing gastric polypus which has become cancerous (Case A73269)

stages of polyposis the prepolypoid stage or the stage of inflammation and the stage of polyposis with malignancy

**CASE 3 (A400776)** Mrs O M B age 50, registered at the Clinic August 8, 1923 because of epigastric pain which began as dullching 6 years before lasting for about 3 weeks Pain had occurred two or three times each year since it was not influenced by season, and each succeeding attack seemed more severe than the preceding one At times there was gnawing pain in the epigastrium The pain was often present on awakening in the morning Relief was obtained from food and soda and there seemed to be definite food relation For the last year attacks had begun about 1 or 2 hours after meals, and increased in severity until the next meal Often the patient was awakened at night and had to eat crackers for relief She never had a sour stomach, but did occasionally belch gas, and abstained from rich and greasy foods for this reason There had been slight fluctuation in weight Except for these symptoms, her general health was good Menopause had occurred following pelvic operation in 1905 She had had influenza in 1903 and otitis media in 1914 and 1919 There was also history of tonsillitis She had had dilatation and curettage 9 and 2 years before

*Ex miasma* A 1 hour specimen of urine showed trace of albumin and an occasional pus cell. The hæmoglobin was 72 per cent erythrocytes numbered





Fig. 3. Low power photomicrograph of one of the finger like projections. Each of the small papillary projections shows typical adenomatous papillary growth in polyps of the gastrointestinal tract (Case A 9999).

4,400,000, red leucocytes 6,000. Gastric analysis 1 interval hours following a repeated fractional test meal revealed total acidity of 1 and no free hydrochloric acid. Dental examination revealed periapical infection and pyorrhea. Roentgenograms of the stomach revealed an extensive gastric lesion which was diagnosed as gastric polyposis. An exploratory operation was performed August 17, 1932. Small soft nodules involving the mucosa could be felt throughout the stomach extending from the pylorus, and especially along the lesser curvature almost to the esophagus. These nodules apparently consisted of both anterior and posterior walls, both greater and lesser curvatures and were most numerous near the pyloric end of the stomach. In the region of the pylorus the thickening formed indistinct masses about 8 or 10 centimeters in diameter. The nodules were somewhat movable and probably pedunculated. The lesion resembled a thickened rugula gastrica. Because of its high extension removal would have required complete gastrectomy, which did not seem advisable. After the stomach had been washed, stripping was noted along the lesser curvature. There were small glands near the lesser curvature but they did not appear to be malignant nor was there evidence of metastasis. The wound was closed with the recommendation that gastroenterostomy be performed, should the patient have pyloric obstruction. Roentgen ray and radium treatments were recommended by the surgeon. A series of roentgen ray treatments were given and the patient was dismissed from the Clinic August 19, 1932. She was advised to continue roentgen ray treatment at home which she did not improve. In the middle of November when the pain recurred. She began to lose weight her appetite became poor and she appeared cachectic. Roentgenograms taken by her physician in December were compared with those

taken here in August. No appreciable progress in the disease was revealed. A series of high output treatments were recommended. Whether or not they will control the disease is uncertain. The relief from symptoms for a period of 2 months following the first series of treatments could seem to indicate a beneficial, although temporary effect. The patient is generally well and the absence of acids in the stomach, constitutes ideal environment for the development of malignant cells. Mills in his series of gastric polyposis, reported but four cases of malignancy.

CASE (A 75265) M. F. J. F. age 45 reported at the Clinic May 30, 1932 because of epigastric pressure and lump in the abdomen. A mother had died from carcinoma of the stomach. The patient had never been sick until the development of the present trouble in May, 1932, when he had felt the sensation of tight belt around the waist and this occurred frequently for about 6 months. In January, 1932, he had noticed lump under the left costal margin which seemed to move toward the right side of the abdomen. This lump appeared to become more solid and pronounced with succeeding attacks of epigastric pressure. Two months before pain had developed in the back beneath the left scapula and radiated to the right scapula. The onset of pain was usually about eleven in the morning and continued until night. The patient was constipated. His appetite was good. When the lump appeared he was troubled with palpitation. At times his legs ached slightly. For the last 6 weeks he had belched considerable gas but had never vomited. He had been losing weight.

Physical examination. The patient was pale, he had edematous prepuce vessels (familial characteristics). He weighed 33 pounds less normal weight as 60. The teeth and mouth were dirty with marked recession of the gums. The systolic blood pressure

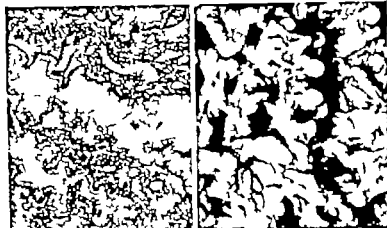


Fig. 4 (left). Cervical polypus. Modified connective tissue stroma in which are seen blood spaces and the adenomatous mucous glands becoming cystic from accumulation of retained mucus. (Case A4 47) ( $\times 50$ )

Fig. 5. Polyposis of colon showing multiple papillary adenomatous growths in this case mucous cysts are visible (gross photograph)

as 95 the diastolic, 60. Soft palpable glands were found in the left axilla. The urinalysis was negative. The hemoglobin was 60, the erythrocytes numbered 4,360,000 and the leucocytes 3,000. The Wassermann reaction was negative. The total acidity of the stomach was 46, the free hydrochloric acid was 20, there were food remnants and trace of blood. Roentgenograms of the chest were negative but they revealed lesion of the outlet of the stomach and retention. Exploration as performed June 7, 1920, and marked thickening of the pyloric half of the wall of the stomach as found. No area of ulceration could be felt. It was thought advisable to open the stomach and examine it from within. A definite thickening of the muscular wall and hypertrophy of the mucous membrane with definite puckering around the pylorus was found. A piece of mucous membrane as removed from this region. The specimen showed inflammatory reaction on repeated microscopic examinations but no evidence of malignancy or ulceration. The inside of the stomach was thoroughly examined but nothing definite could be felt. The opening in the anterior wall was closed and posterior gastro-enterostomy made to relieve obstruction. The appendix was removed.

The patient returned to the Clinic September 6, 1920. For 6 months following operation he had been very much better, had rapidly gained weight, normal, and had followed his usual occupation. Following an attack of influenza, however, he began to have pain in the back, belching gas and also had abdominal pain beginning about eleven in the morning. Food had no effect on this pain. He also described an epigastric pain which was more severe than the general abdominal pain which was made worse by food and which seemed to localize around the umbilicus. For the last month he had been vomiting sometimes food (ate days) before the

vomitus always contained bile. Examination of the contents of the stomach revealed a total acidity of 50, free hydrochloric acid 20, food remnants 3, and blood. A roentgenogram of the stomach revealed gastrojejunal ulcer with retention. A roentgenogram of the chest was negative. September 3, 1920, an exploration for gastrojejunal ulcer was performed. After separating the gastro-enterostomy which was difficult because of adhesions, the stomach was opened and found to contain a gastrojejunal ulcer and also marked polyposis along the lesser curvature which had undergone malignant change. Obstruction was due to one polypus blocking the pylorus, and another the gastrojejunal opening. About one half of the stomach and 5 centimeters of the duodenum were removed. The stump was closed with one row of silk and one of chromic catgut. The opening in the jejunum after being separated from the stomach was closed with two rows of chromic catgut. The stomach and jejunum were anastomosed 40 centimeters below the ligament of Treitz with two rows of chromic catgut. An old duodenal ulcer scar ring on the duodenum was excised. The operation was difficult because of many adhesions from the former operation. The patient left the hospital September 26, 1920. He received series of roentgen ray treatments, at the Clinic, before he was dismissed.

From October until April the patient felt fairly well, gained in weight and strength, and did his ordinary work. He then began to have the old pain in the back, with belching, nausea, and occasionally vomiting. His lost strength rapidly vomited became much more frequent, occurring half an hour after meals, four times a week. He returned to the Clinic July 8, 1921, and on physical examination palpable glands were found on the rectal shelf. Roentgenograms revealed recurring carcinoma of



Fig. 6



Fig. 7



Fig. 8

Fig. 6 Small portions of mucosa-secreting stomach polyps, with connective tissue cores carrying many capillaries. There is an inflammatory type of covering, the marked inflammatory reaction throughout (Case 1, 3354) (X 50).

Fig. 7 Anastomosing type of nasal polyps, showing predominance of gland structure over stroma, which is

more bluish than mucosa. Large blood vessels are seen and considerable round-cell infiltration (Case 1, 3737) (X 50).

Fig. 8 Pure anastomosing nasal polyps with predominance of anastomosing structure and absence of glands. A blood vessel and few anastomosing cells represent (Case 1, 3737) (X 50).

the stomach and peculiar opacity of the ribs suggesting metastases. Pathologic roentgen treatment of the gastric growth and the metastatic areas was advised. The result from treatment: free total acids: free hydrochloric acid and mucus 3.

At first it seemed that this might be one of the rare cases which Menetrier described as polyadenoma *exaggerata* of which there are but three reported in the literature including two of Menetrier. In this condition instead of the hypertrophy and hyperplasia being limited to a part they involve equally the entire mucous membrane in an area so that large plaques are formed and not polyps. The involved area is usually from two to five times the normal thickness of the mucous membrane and the consistency as soft as normal mucous membrane. The membrane develops in large folds parallel to the long axis of the stomach and a sharp line of demarcation is present between the normal mucosa and the diseased area. However the pylorus is never involved. The patient in this case was first operated on June 7, 1910, for a stomach lesion at outlet with retention. No malignancy, ulcer, polypus or anatomical defect was found. There was however marked thickening of the wall of the pyloric half of the stomach with hypertrophy and puckering of

the mucous membrane. Microscopic examination of specimens removed revealed marked inflammation. These sections did not suggest small cell carcinoma (leather bottle type) nor were there visible grossly on inspection of the serosal surface of the thickened stomach any of those fine white lines which Broders has recently described as characteristic of this type of carcinoma. The patient went home and improved for 6 months, then had a recurrence of symptoms. He returned to the Clinic, and had a second operation 15 months after the first. A gastrojejunal ulcer and a rather diffuse polypoid papillary growth of the lesser curvature of the stomach, on microscopic examination proved to be adenocarcinoma. Thus there is tactile, visual, and biopsy proof of chronic gastritis with hypertrophy of the muscular wall and mucous membrane followed by polypoid papillary growths, and finally by carcinomatous change in these growths. There was no ulceration of the gastric mucosa.

This case belongs in the group of cases described by Menetrier as polyadenoma polypus and tend to confirm his opinion that polyps are of inflammatory origin. There is no similar case reported in the literature which so confirms the correctness of the terminology

gastritis polyposa. It seems probable that Menetrier examined his patients in the pre-polypoid stage of their diseases.

#### BIOPSY

In the case of multiple polypi of the rectum and sigmoid, biopsy is often of the utmost importance. Since these growths are easily accessible through a proctoscope and since at times, a biopsy may be the only means of making a positive diagnosis, it certainly seems justifiable to take such a specimen. Unfortunately the fact that one or two of these tumors do not show malignant transformation proves nothing with regard to the others. A perfectly benign adenoma may be almost contiguous with one which has undergone marked malignant transformation. A positive negative opinion cannot, therefore be given in these cases. This is illustrated by Case 6 (A406078). Specimens from two different polypi were removed for microscopic examination. One was reported as an "adenomatous polyp," and the other as a "carcinomatous polyp of low grade malignancy." The chances are that in about three of four cases of multiple adenoma malignancy occurs in some of the growths sooner or later (32). The specimen may be taken from the pedicle, base, body or surface of the polypus according to the operator's judgment and knowledge of pathology. According to Ewing, "The carcinomatous transformation of these polyps may begin at the base, tip or throughout the polyp."

Because of the tendency of adenomata and papillomata to be transformed or to recur in the form of carcinoma, it is wise to treat them as such from the beginning. For purposes of prognosis, neoplasms should be distinguished if possible, for a favorable opinion is more justifiable in cases in which malignancy has not appeared.

Case 8 (A377305) illustrates the possible danger of aggravating the growth of the polyps by trauma. Malignancy of the cervix was suspected because of its appearance and feel, although there was absolutely no history which suggested it. The patient's complaint was entirely rectal. A specimen was removed from the cervix and reported to be highly inflammatory. Ca. tery was applied to the cervix. For 6 months she was fairly well, and the diarrhea

was considerably diminished. A foul, irritative occasionally blood streaked vaginal discharge then appeared, persisted for 2 months, and became somewhat less in amount. A physician was consulted, who advised that she return to the Clinic, which she did, 9 months later. Examination at this time showed an extensive cervical growth. The biopsy report was "squamous cell epithelioma 4." Heavy doses of radium were used, but the response was apparently not great. The patient returned home and continued her roentgen ray and radium treatments. Our prognosis was fair to poor. However, recent letter from her home physician states that he is unable to find anything in the pelvis. January 7, 1923, the patient wrote: "Gaining in strength and weight, no diarrhea or vaginal discharge, feel fine."

In this case three possibilities may be considered. The specimen may have been taken from a non-malignant site; the report "very inflammatory" was a precursor of what was developing into malignancy; or the removal of a specimen actually lit up malignancy. It is probable however that malignancy was already present. The removal of the cervical polypus and biopsy specimen may have hastened the cancerous change in the cervix, the cautery not being sufficient completely to eradicate malignant cells which were probably present near though not in, the first biopsy specimen. Evidently the rectal polyp were not in the precancerous stage or the excision was sufficiently thorough so that cancerous tissue was entirely eradicated.

#### DISCUSSION

Two practical problems are confronted in a consideration of these cases: the advantage of a positive diagnosis and the danger of aggravating malignancy by trauma. A special committee of the Society for the Control of Cancer prepared a report for the Department of Health of the City of New York in which they concluded that it is universally agreed by surgeons and pathologists that in a large group of cases the former advantage decidedly outweighs the danger of the latter. This is particularly true in the cases of multiple polyposis of the lower gastro-intestinal tract for they are superficial growths easily approached. An early diagnosis of malignancy in a localized area, like a polypus, should certainly give a more favorable prognosis than the same report in a more advanced stage of the disease.

The nomenclature of the adenomatous and polypoid types of growth is so varied that the following differentiation may be acceptable. Papillary tumors may occur anywhere on the surface or within the lumen or duct of an organ and are usually multiple. They may be adenomatous, and when in the gastrointestinal tract they are spoken of as polypi. New-growths of mesodermic tissue or pedunculated skin should not be called polypi. In this type of growth the stroma is sometimes dense and hard from compact fibrous tissue, but may be soft and myxomatous. The proportion of stroma to epithelial elements varies widely. Bland Sutton says, "There is reason to believe that the intestinal, as well as the cutaneous growths sometimes disappear spontaneously."

*Gross appearance of polypi.* Polypi of the stomach and intestines appear grossly as cauliflower-like growths projecting into the lumen, coarsely or finely lobulated; they are usually soft, reddish or purplish velvety masses with considerable variation in form and consistency (depending on the character of epithelium from which they grow) as well as in the amount and consistency of the stroma, often ulcerated, and covered with inflammatory exudate.

*Microscopic appearance.* A large proportion of the tumors are made up of glands larger than normal, lined with cylindrical epithelium of high goblet type, and secreting mucus. They often stain more deeply than normal glands. Obstruction to glands may result in epithelial-lined spaces and cystic areas which in turn, may have ingrowths of epithelium to form daughter papillae.

The glands are embedded in a stroma of connective tissue carrying blood vessels in which there is almost constantly considerable inflammatory reaction with small round-cell infiltration and occasional mast cells. The amount of fibrosis varies. The stroma is often myxomatous. There is no uniform proportion between amounts of glandular elements and stroma, but in the gastro-intestinal tract the glands comprise the majority of tissue. The surface is frequently ulcerated or covered with elements of exudate as evidenced by fibrous strands and epithelial debris and skele-

tons of erythrocytes and leucocytes. Most of these polypi then are merely pedunculated adenomata.

In cryptitis of the crypts of Morgagni there is often associated marked hypertrophy of the mucous membrane of the papillae. This hypertrophy is at times so marked that the papillae are enormously enlarged, and in some instances as thick as an adult's thumb. To the examining finger and through the proctoscope, to one not familiar with this condition, they may appear to be polypi, and are so diagnosed; but the condition is really papillitis.

All intestinal tumors incline toward the direction of least resistance and therefore protrude within the lumen of the bowel. Because of this, a variety of benign and malignant tumorous growths develop, between which the distinction is not always clear. Histologically we find that in benign tumors the cellular elements are fully differentiated and normally arranged, whereas in malignant tumors the cellular elements are irregularly arranged, imperfectly differentiated and are found growing outside their normal sites. Further than this we do not know what inherent qualities or characteristics render one neoplasm benign and another malignant.

Polypi of the nasal passages and of the intestinal passages may be similar in structure, although the former only rarely if ever become malignant. In the nares, more than in any other mucous membrane, the polypoid outgrowth due to chronic inflammation, lacks the histological features of an autonomous new-growth. In fact, many nasal polypi consist of nothing more than localized oedematous areas of mucous membrane rendered protuberant by mechanical means, but without other changes. Once established, however, these masses are subject to various degrees of hyperplasia of their elements which render them not only persistent but often progressive, and in such cases there may be considerable change in their appearance and the proportion of various cells. Since this change is seldom pronounced, the groups of nasal polypi stand among the purest examples of neoplasms of inflammatory origin.

Nasal polypi are probably always preceded by chronic rhinitis, yet they rarely if ever

become malignant. Rectal polypi, existing under entirely different circumstances are submitted to traumatism, stress and strain and the action of bacteria. On the basis of the collected statistics of Deering and Soper 26 (43 per cent) of rectal polypi were malignant. In my previous series of 39 cases 2 (11 per cent) of 18 specimens removed at operation were malignant, and 2 of 19 biopsy specimens from the rectum both from cases which came to operation later were adenocarcinoma.

**Malignancy** In the present series of 20 cases 9 specimens were removed at operation and 3 of these showed malignancy. Two specimens removed from patients not operated on were malignant. Thus malignancy was evident in 5 (45.5 per cent) of 11 specimens. From the total series of 59 cases observed at the Mayo Clinic, 29 specimens were removed 9 (31.2 per cent) were reported malignant and of these 6 (66.6 per cent) were adenocarcinoma.

In the adenomata the glandular element is the essential part while in the papillomata it is the stroma. Simple irritative and regenerative hyperplasia, adenomatous growth, and carcinoma are successive stages which are manifested by the same kind of tissue. The difference is one of degree and not of kind. Loosely speaking we may regard carcinomata as adenomata or papillomata which have developed into malignant growths. In the intestinal tract the adenomatous type of growth certainly predominates. In the group of 20 cases, 8 (72.72 per cent) of 11 specimens were reported as adenomatous growths and of the entire series of 59 cases from the Mayo Clinic 14 (23.7 per cent) were adenomatous types of growths.

**Etiology** There are many interesting theories advanced as to the formation of polypi. Huber has attempted to show that these tumors are the result of a general systemic lymphatic hypertrophy. He argues that they all belong to that class in which there are lymphoid hypertrophies and "other manifestations of the constitutive lymphatic status lymphaticus." Myer believes that multiple polyposis of the gastro-intestinal tract is due to congenital malformation of the intestinal wall which extends into the mucosa and sub

mucosa. The entire epithelial reaction he considers secondary. This belief is probably further strengthened by the familial tendency and in his cases the occurrence in early life. Hertz, Mueller and Rotter (quoted by Rosenberger) all believe polyposis to be a familial disease. Rotter also considers polyposis a new growth on a congenital basis although absolute proof is lacking. However it is hard to believe that such congenital defects would so often be multiple. would give rise to epithelial reaction of such variable appearance and would predominate in the rectum and colon. The familial tendency has in no way entered into the series herewith reported neither have these cases occurred in early life. Fifteen (75 per cent) of the 20 occurred after 40 years of age. Of the 39 cases which I reported in 1920 15 (38.4 per cent) occurred between 19 and 30 years of age while 24 (61.6 per cent) occurred after 30.

The present series of cases bears out the findings in a previous series of the definite relationship between chronic ulcerative colitis and multiple polyposis. Six (30 per cent) of these patients had chronic ulcerative colitis. Chronic ulcerative colitis has long been thought to be due to infection, and all etiologic studies up to the present time seem to have been devoted to an endeavor to isolate a specific organism chiefly the dysentery bacillus *Citrobacter histolytica* or the streptococcus. As the result of recent investigations combined with certain clinical observations, Brown believes the conditions to be the result of metabolic changes which so lower the resistance of the bowel that the mucosa is an easy prey to invasion by the organisms which are always present in the colon. This ulcerative process, although severe and chronic, is such that portions of the mucosa and submucosa adjacent to and supplied by primary arterial branches are preserved. It is these preserved portions that are seen studding the surface of the colon. As healing takes place under favorable conditions the irregular margins of these elevations are smoothed off and remain as rounded sessile or polypoid projections from the mucous membrane. This is the so-called multiple polyposis or colitis polyposis. As in all healing processes the prolifer

ated fibroblasts begin to contract with resultant cicatrization and a natural result could be the occlusion of the tubules in the polyp. So long as the secreting cells in the walls of the polyp functionate they increase in size with the formation of retention cysts. Several tubules thus occluded in polyp will cause the polyp to appear as a collection of cysts. Thus this condition which is probably but an advanced stage of colitis polyposa, is what Virchow designated as colitis polyposa cystica.

The elevation of the thickened mucosa results in increased friction and traction which in turn stretch the surrounding adjacent mucosa and cause the formation of a pedicle. Further changes may in turn result in fibrosis and severe inflammatory conditions the final and most important of which is carcinomatosis. The factors giving rise to carcinoma are generally accepted to be irritants in the form of chemical biochemical or radio-active substances. Of these the most common especially in carcinoma of the mucous tracts are the biochemical or the bacterial elements. Thus, the malignancy of adenomata, papillomata, or polyp of the gastro-intestinal tract is due to the more persistent and violent action of the infecting organism, or to the increased trauma which is necessarily accentuated by the passage of feces, and possibly by the compression of the bowel itself in its effort to pass on both feces and polyp.

Schwab early advanced the theory that polyposis is due to chronic constipation, and that polyposis begins in the rectum and then ascends the gastro-intestinal tract. The prevalence of constipation in females, and of polyposis in males, tends to rule out this theory but on the other hand, the theory is strengthened by the facts that polyp predominate in the rectum where the formed feces would cause the maximal irritation by the constant mechanical and bacterial action that they often occur at the points of flexure where the mechanical action of the fecal contents is exaggerated, and that they are comparatively rare in the small intestine with its fluid contents and minimal bacterial action. However if constipation were the principal cause of polyposis, the condition should be more common.

*Intussusception.* There was but one case of obstruction and none of intussusception in my series. The obstruction occurred in the patient with gastric polyposis (Case 3) and followed posterior gastro-enterostomy. One polypus blocked the pyloric outlet, and one the gastro-enterostomy stoma. In the cases collected from the literature, there is but one case of intussusception the case of Cope, and this occurred in the small intestine and was caused by pedunculated papillomata. I have been under the impression that only pedicled tumors can be held responsible for intussusception. Evidently this is not correct, for Bland Sutton makes reference to an extraordinary set of specimens in the Museum of the Royal College of Surgeons in which broad based tumors were the cause. The pedicled growths are most common in children, and the fact that there were no children in my series may account for the absence of cases of intussusception.

*Symptoms.* Symptoms vary with the size, position, and number of the polyp. Generally patients in whom the polyp are localized in the rectum and sigmoid have a sense of weight, a loaded feeling in the rectum and occasionally tenesmus with, or without, bleeding. If the polyp are pedicled and low they may protrude from the rectum as in the case of Edwards. If unusually large numbers of polyp are present prolapse of the rectum may occur as in the cases of Mueller and Norbury. Diarrhea is practically always present. Diarrhea and extensive involvement of the colon are usually associated with discharge of pus and blood.

Involvement of the colon first causes a sense of fullness and later a vague abdominal pain which may be localized at the seat of involvement. A complete or partial obstruction of the bowel will result in stasis and the formation of toxins which have an inhibitory action on the proximal section and cause distention. If this is progressive symptoms other than those at the original site of involvement may mask the real condition.

According to Hurst the sensation of fullness in the gastro-intestinal canal is due to a slow increase in the tension exerted on the fibers of its coats the adequate tension is adequate for

each segment but the volume of contents necessary to produce this tension varies with the tone of the muscular fibers.

The only immediate cause of true visceral pain is tension. This is exerted on the muscular coat of hollow organs and on the fibrous capsule of solid organs. The sensation of pain in the alimentary canal is due to a more rapid or greater increase in tension on the fibers of its muscular coat than that which constitutes the adequate stimulus for the sensation of fullness.

A large percentage of lesions of the colon cause pain in the ascending colon around the cecum and appendix.

Gastriitis polyposa has no really characteristic symptoms. A pain localized in the epigastrium not associated with burning or with the usual symptoms of hyperacidity but occurring only when the stomach is empty seems to be quite constant. It is relieved by food it is not influenced by pressure, and it does not radiate. Gastric analysis may show a total absence of free hydrochloric acid and excess of mucus as in the cases of Balfour and Myer and in Case 3 of this series. This achylia explains in a measure the symptoms of which these patients complain. Sooner or later there is a loss of weight, and the anemia which develops varies with the degree of bleeding. The so called essential hemorrhage did not occur in any patient in this series. Repeated attacks of colic with obscure etiology and symptoms pointing to obstruction suggest polyposis.

*Treatment.* Since no specific etiological factor is known, the treatment of intestinal polyposis varies with the individual case. In a case of multiple polypi of the rectum, Aubertin and Beaujard obtained definite results following twenty-five radium treatments there was a marked diminution in size of the polypi and distinct improvement. The mucosa of the rectum and sigmoid seem especially susceptible to the rays. Mueller suggests the use of mineral salts in the intestinal tract before exposure to the rays thus obtaining secondary radiation.

Carnot, Friedel and Froussard effected a cure in a case of generalized polyposis of the terminal bowel by local application of magnesium chloride. They describe the technique

as follows. Each day following a cleansing enema, the recto-sigmoid was dressed with a thick agar mudlage containing at first 10 grams of magnesium chloride in 250 grams of the vehicle. Later this was reduced to 5 grams in 250 grams. The mudlage was introduced above the stenosis the lumen of the bowel no longer admitting the finger using a sound and a Guyon syringe. The dressing was borne easily and retained longer each time from 2 to 10 hours. Five gram strength was borne best. At the end of 3 weeks the ulceration had healed at the end of 3 months constriction had entirely disappeared and most of the polypi were gone. At the end of 6 months very few polypi remained and these were minute. These writers confirmed the fact that the rectosigmoidal segment of the bowel is subject to reverse peristalsis if the desire to empty the bowel is resisted. They injected 50 grams of bismuth paste and by roentgenoscopy observed that it was carried to the cecum. Hence it is evident that the local dressing which is injected would be carried up and spread around.

If polypi are localized in the rectum treatment by cauterization or excision may be used. The patients should be kept under observation and if any signs of malignancy develop resection of the rectum performed. When the growths are located elsewhere in the gastrointestinal tract, either of two procedures may be employed to relieve the sufferers. The first colostomy carries with it very little danger but is not always certain in its results. The second and radical method is intestinal resection which carries with it a very great danger. The grade and extent of involvement must be determined as accurately as possible. A thorough examination at operation will not always reveal as extensive a process as necropsy will show. However if operation is indicated it undoubtedly offers the best results.

#### CONCLUSIONS

1 Multiple polyposis of the intestinal tract is a serious disease from the standpoint of morbidity and mortality.

2 The cause of intestinal polyposis is not known although chronic ulcerative colitis appears to be a prominent factor.



3 There is no specific medical treatment and operation undoubtedly offers the best results in all cases

4 The predominant symptoms are diarrhea, with the passage of pus and blood vague abdominal pain and rectal tenesmus.

5 Multiple polyposis is a disease of the large intestines and of the stomach. The small intestines are rarely involved

6 Proctoscopic examination should be made routinely in all cases of dysentery of more than a few days duration

7 The roentgen ray is practically the only means of diagnosing multiple polyposis of the stomach or above reach of the proctoscope in the bowel

8 The disease terminates in malignancy in a large percentage of cases

9 Most marked involvement of the colon is found in the cases which begin as a mild diarrhoea and later become chronic.

10 The findings in one patient would tend to confirm the correctness of Menetrier's terminology gastritis polyposis

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## A STUDY OF THE GROWING POWER OF PERIOSTEAL CALLUS WHEN TRANSPLANTED TO COSTAL CARTILAGES

By GEORGE H. KLINKERFUSS, M.D. S. LOUIS

Anatomical Laboratories University of Missouri

THIS work was undertaken to compare the differences between the growing power of autotransplants of periosteal callus and of solid bone when grafted to the costal cartilages. Periosteal callus was selected because at certain stages it is composed of rapidly proliferating osteoblasts, on a highly vascularized stroma and therefore it was thought that this tissue would generate bone much more rapidly than solid bone which must first be brought to the stage of active growth after transplantation. Then too it has been demonstrated that solid bone transplants are usually absorbed being replaced by new bone formed by the actively growing osteoblasts of the periosteal layer, haversian canals and endosteum.

The costal cartilage was selected as the most suitable site for transplantation, because (1) as pointed out by Berg and Thalheimer in the costal cartilage all the factors necessary for bone growth are fulfilled i.e. stress and strain, function and a medium identical with the embryonic development of bone in cartilage, except for the blood supply and (2) the results could be judged more accurately than if the transplant were made to another bone because on the cartilage all new bone formed most probably comes from the transplant.

The animals used were rabbits of the large brown Belgian variety in the period of active growth. They were carefully fed and kept under the best possible living conditions. All animals that became infected or did not gain weight regularly were discarded, and the results were not used in forming our conclusions. As nearly as possible animals of about the same age were used at the time of the transplant operation. There were in all eleven successful experiments.

### TECHNIQUE

The experiments were carried out under ether anesthesia, and the strictest aseptic

precautions were used throughout. The first operation was performed to produce the periosteal callus. This was done by carefully dissecting the muscles clear of the ulna, so as to get a large exposure of the middle third of the shaft. One longitudinal and three transverse saw cuts were made on this area with a guarded circular power saw, care being taken not to cut entirely through the cortex of the bone. The periosteum was not stripped off. The wound was closed in layers, and a collodion dressing was applied.

The callus was allowed to grow from 7 to 21 days, and then transplanted. First, the callus was carefully cut from the ulna with a small heavy bladed knife. Part of the callus was fixed in Zenker's solution for microscopic study. Then with the same saw used in the first operation a small piece of bone, about 1 by 4 millimeters was cut from the proximal third of the ulna, a reasonable distance from the area of callus formation. This piece of bone was the entire thickness of the shaft, consisting of periosteum, cortex and endosteum and was used as a control. Next the thoracic wall was incised to the muscle layer, the pectoral muscles separated over the area of costal cartilages, and a good exposure of the cartilages obtained. The perichondrium was now scraped from the cartilages to about 1 millimeter in depth to form a bed for the transplants. The transplants which had been kept in a piece of gauze saturated with warm Ringer's solution, were now tied to the cartilages with fine black silk sutures. Each transplant was put on a separate cartilage. The wound was then closed in layers with silk, and the skin covered with a collodion dressing.

The rabbits were sacrificed at periods varying from 1 week to 7 months. The whole anterior thoracic wall was removed and X-ray photographs made to show the amount of shadow cast by the grafts, and to aid in locating the specimens. The specimens were fixed in Zenker's fluid, decalcified, carved through

graded alcohol and embedded in celloidin for sectioning. Serial sections were made of all 1 cm. They were cut at fifteen mil range and stained in alum haematoxylin and eosin.

#### CALLUS AT TIME OF TRANSPLANTATION

The seven day callus (Fig. 1) cut very easily when removed from the ulna and in the gross, had the appearance of vascular fibrous tissue. Microscopically it consisted of large round cell with a very dark staining round nucleus placed centrally in a clear homogeneous cytoplasm. These cells were apparently held together by a reticulum of embryonic connective tissue cell and thin walled capillaries. The whole section was studded with osteoclasts.

The 11 day callus (Fig. 2) cut with a gritty feel to the knife indicating a deposit of calcium salts. Grossly it looked like the seven day callus except that it was not so vascular. Microscopically the appearance was quite different. The whole callus consisted of loosely arranged cell resembling embryonic cartilage. The nuclei were large and reticular surrounded by a small rim of clear cytoplasm as seen in the osteoclast of the 7 day callus (Fig. 1). In addition a mass of interlacing fibrils, staining faintly with eosin had been laid down. Around the capillaries the cells were more loosely packed with pyknotic nuclei and a heavier cytoplasm which stained more densely with eosin. These cells were evidently undergoing calcification. Immediately surrounding the capillaries, there were concentric layers of proliferating osteoblast. On the whole evidence of bone trabeculation were clearly seen.

The 14 day callus (Fig. 3) was rather difficult to cut with the knife owing to the amount of calcification. It had the appearance of very vascular bone in the gross. Microscopically it showed that new bone formation had progressed considerably. There were trabeculae of rather solid bone with capillaries surrounded by concentric circles of proliferating osteogenetic cells in their spaces. Here also osteoblasts could be seen in large numbers.

The 21 day callus was very hard and had to be chipped from the bone. In the gross, it

looked like cancellous bone but was much less vascular than the 14 day specimens (Fig. 3). Microscopically it was exactly like cancellous bone except that the spaces containing the capillaries still showed actively growing osteoblasts but less abundant than in the 14 day specimens.

#### TRANSPLANTS

Figure 4 A shows a seven day growth of a callus transplant on a costal cartilage. This callus was 10 days old at the time of transplantation. There is only a diffuse shadow cast on the X ray plate which any of the soft tissues may well produce. But in the section (Fig. 5) the transplant is bound to the defect in the costal cartilage by new connective tissue and among the connective tissue cells can be seen many osteoblasts, coming from the edges of the trabeculae of the callus. Growth is evidently in active progress. The edge of the cartilage does not show any activity. In places where the cartilage had been denuded of perichondrium the sharp edges of the cartilage have been absorbed and for several layers deep the cartilage cells fall to waste and are evidently necrotic.

Figure 4 B shows the dense shadow cast by the bone transplant after 7 days of growth. The edges are sharply defined and from X ray appearances not much change has taken place. In section (Fig. 6) the transplant is surrounded by a dense capsule of new connective tissue but there are only a few osteoblasts at the edge of the capsule that seem alive. In the mass of the bone the cells stain faintly or the lacunae are empty and are apparently dead. The whole transplant has called forth a reaction of the surrounding tissues, as if it were a foreign body. The cartilage has not started to react and appears as described above.

Here we have after 7 days a comparison advantageous to the callus transplant as far as bone forming power is concerned. It also shows that the callus transplant lives almost entirely while the bone for the most part seems dormant. The edges of the cartilage have not reacted and are being absorbed.

Unfortunately the experiments of 14 days showed an infection of both transplants,

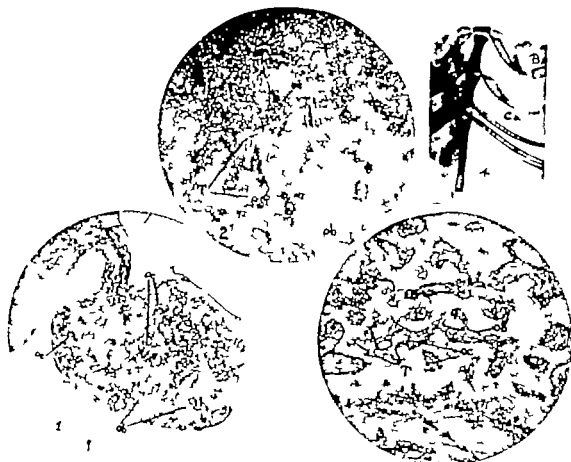


Fig. 3 Photomicrograph of perosteal callus 7 days  
aa Osteoblasts or osteoclasts ( $\times 65$ )

Fig. 4 Photomicrograph of perosteal callus at 7 days  
aa Osteoblasts resembling embryonic cartilage cells or group of osteoclasts T beginning trabeculation ( $\times 65$ )

Fig. 5 Photomicrograph of perosteal callus at 4 days

aa Osteoblasts lining bone trabecula or osteoclasts in bone spaces, T trabeculae of new bone ( $\times 65$ )

Fig. 6 X ray photograph of the sternum and costal cartilages 7 days after transplant operation B Bone spicule Ca location of callus graft Sections shown in Figures 5 and 6

when studied microscopically and had to be eliminated.

The next experiment in chronological order is that of 30 days growth. This callus transplant was 7 days old at the time of transplantation. Here the X ray shows the shadow of the callus projecting from the cartilage in a rounded dome shaped mass (Fig. 7 Ca) that casts a distinct shadow around its circumference leaving a fainter zone at the junction with the cartilage. The bone shadow on the cartilage above (Fig. 7 B) is quite dense, but is very much smaller than when it was transplanted, and now shows jagged ill defined

edges. The callus shadow shows a great gain in growth over that of the solid bone.

On microscopic examination of the callus transplant (Fig. 8) there is seen a large rounded mass of new cancellous bone in active growth separated from the cartilage by a zone of new cartilage cells arranged in parallel rows, mingling on the one hand with newly formed ossified bone trabeculae and on the other stopping abruptly at the edge of the infused cartilage. The new bone stains a brilliant red with eosin the rows of disc like cartilage cells are dark blue on a pale blue stroma while the old cartilage stroma stains a pale red. At

graded alcohol and embedded in celloidin for sectioning. Serial sections were made of all specimens. They were cut at fifteen micra, and stained in alum hematoxylin and eosin.

#### CALLUS AT TIME OF TRANSPLANTATION

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The 11 day callus (Fig. 2) cut with a gritty feel to the knife indicating a deposit of calcium salt. Grossly it looked like the seven day callus except that it was not so vascular. Microscopically the appearance was quite different. The whole callus consisted of loosely arranged cells resembling embryonic cartilage. The nuclei were large and reticular surrounded by a small rim of clear cytoplasm as seen in the osteoblasts of the 7 day callus (Fig. 1). In addition a mass of intralacing fibril staining faintly with eosin had been laid down. Around the capillaries the cells were more densely packed with pyknotic nuclei and a heavier cytoplasm which stained more intensely with eosin. These cells were evidently undergoing calcification. Immediately surrounding the apophyses there were concentric layers of proliferating osteoblasts. On the whole evidence of bone trabeculation were clearly seen.

The 14 day callus (Fig. 3) was rather difficult to cut with the knife owing to the amount of calcification. It had the appearance of very vascular bone in the gross. Microscopically it showed that new bone formation had progressed considerably. There were trabeculae of rather solid line with capillaries surrounded by concentric track of proliferating osteogenic cells in their spaces. Here also osteoblasts could be seen in large numbers.

The 21 day callus was very hard and had to be chipped from the bone. In the gross it

looked like cancellous bone but less vascular than the 14 day (Fig. 3). Microscopically it was cancellous bone except that it lacking the capillaries still showing growing at oblique but less at in the 14 day specimens.

#### TRANSPLANTS

Figure 4 *Ca* shows a seven day callus transplant on a costal callus was 10 days old at transplantation. There is only a crack on the X-ray plate while the tissues may well produce it. (Fig. 5) the transplant is buried in the costal cartilage by new tissue and among the connectives can be seen many osteoblasts at the edges of the trabeculae. Growth is evidently in the act as the edge of the cartilage does not fit. In places where the denuded of perichondrium of the cartilage have been several layers deep the cracks stain and are evidently new.

Figure 4 *B* shows the dead bone transplant alone. The edges are sharply defined and the appearance is not much like in section (Fig. 4 *B*) surrounded by a dense active tissue but there is blast at the edge of the callus. In the mass of it faintly or the lacuna apparently dead. The callus is with a reaction tissue, as if it were cartilage has not started as described above.

Here we have after antagonism to the new bone forming power show that the callus is actually while the bone seems dormant. The have not reacted and

Unfortunately the showed an infection

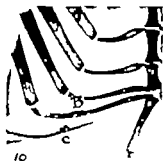
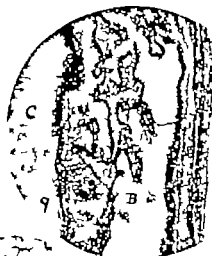


Fig 9 Photomicrograph of bone transplant on costal cartilage after 30 days growth C Costal cartilage B bone transplant Same animal as Figure 8 (X65)

Fig 10 X-ray photograph of the sternum and costal cartilages after 30 days growth B Bone transplant C costal cartilage U medullary canal Sections show in Figures 9 and 10

Fig 11 Photomicrograph of bone transplant on costal cartilage after 60 days growth C Costal cartilage B bone transplant U medullary canal with hematopoietic tissue Same animal as Figures 9 and 10 (X65)

Fig 12 Photomicrograph of bone transplant on costal cartilage after 60 days growth C Costal cartilage B bone transplant U medullary canal with hematopoietic tissue Same animal as Figures 9 and 10 (X65)

cartilage or the callus graft (Fig 8 *sp*) But we think the evidence of its non-appearance in the experiments where only an injury was made to the cartilage or only a suture tied around the cartilage or in the solid bone transplants, and its presence only in the callus transplants, points to its formation by the callus Berg and Thalheimer (2) and Haas (7) were able to produce such an epiphyseal line with periosteal transplants on costal cartilages, but our callus grafts only produced them

After 30 days the rabbits were sacrificed at about 30 day periods and our studies show that the callus graft is always far ahead of the bone transplant in its bone generating power. At 60 days, the callus shows the formation of a medullary cavity with hematopoietic tissue. The old spicule of bone of the bone graft has been nearly absorbed showing only new bone tissue on the cartilage. The later experiments, 90 to 215 days, show no new features, except that the callus and bone transplants more nearly resemble each other both in the X ray

plates and in microscopic section (Figs 10, 11 and 12). These figures show the transplants after 210 days. The active growth of both transplants seems to have subsided and each transplant resembles a long bone lying parallel to a costal cartilage and firmly attached to it. There is a periosteum, a cortex and a medulla with active hematopoietic tissue.

#### DISCUSSION AND CONCLUSIONS

It has been shown by Ollier (11), Axhausen (1), Hey Groves (8), Phémisier (12) and many others that when solid bone is transplanted, most if not all of the bone cells die and the bone is absorbed; that new bone is formed only from the osteoblasts of the endosteum, Haversian canals, and the cambium layer of the periosteum. It has also been shown that transplanted periosteum if it includes the cambium layer gives rise to new bone. We have been unable to find any mention in the literature as to the fate of transplanted bone callus. These studies have shown that bone callus taken from 10 to 14 days after the injury to the bone and transplanted to the costal cartilage of the same animal forms new bone more quickly and in greater amount than do pieces of compact resting bone similarly treated. The difference however, lasts only for the first 60 or 90 days. After this time there is no marked difference between the two. Both eventually produce all the elements of bone: periosteum, cortex and medullary cavity with active hematopoietic tissue forming a miniature of the bone from which they were cut. The persistence of the bone when transplanted to costal cartilage agrees with the findings of others that bone if transplanted to a place in which it is subjected to the action of ultimate stress and strain will form new bone that survives while if transplanted to a soft tissue such as a muscle it will form new bone but this will eventually be entirely absorbed.

The explanation for the more successful growth of callus as compared with compact bone seems obvious. It is composed entirely of cells in a state of active new bone formation. Its nutrition and circulation are rapidly re-established in the new location because the looseness of its texture permits the easy

diffusion of the tissue juices from the surrounding tissues and the rapid growth of blood capillaries. Compact bone on the other hand, is composed of an extremely dense tissue through which tissue fluids cannot permeate except for a very short distance. The only cells therefore which survive are the ones at the very surface of the bone and of these, probably only those which have not yet differentiated into the typical bone compounds.

The use of costal cartilage as the structure to which the transplantation is made proved in the main most satisfactory. It is a tissue closely related to bone and hence favorable to bone growth and there is provided the factor of stress and strain which is important for the persistence of the graft. The only uncertain factor introduced by its use is the possibility that some of the bone formed may be formed by the transformation of the cartilage. Haas (7) has found that costal cartilages, when operated upon undergo calcification. We performed some experiments to test this point and found that cartilages which were injured by scraping or by the application of a silk suture did not undergo calcification, but were replaced by the formation of new cartilage. Careful study of the cartilage in the experiments in which callus or bone had been grafted on to the cartilage showed that during the first 2 weeks a definite line separated the grafted tissues from the cartilage and that the cartilage cells near the surface lost their staining properties apparently becoming necrotic. During this period there was active new bone formation on the part of the graft. Later there appeared particularly in the callus graft a zone between graft and cartilage which much resembled an epiphyseal line of growing bone. It was impossible to be certain whether in this zone the cartilage cells which presented the typical picture of cartilage replacement by bone were derived from the cartilage or from the graft. Berg and Thalheimer (2) described the same phenomenon, and were also unable to determine the origin of the cells of this zone. However this appeared late in the experiments, and did not affect the early changes which were the ones in which the chief difference was noted between the callus and the solid bone grafts.

In no case did bone completely replace cartilage.

The following conclusions would seem to be justified:

1. Callus grafts do not die but continue growing after transplantation.

2. Solid bone grafts, in the main die are absorbed and replaced by new bone tissue resulting from the proliferating of osteoblasts of the periosteum, endosteum, and haversian canals.

3. Callus grafts form new bone more rapidly and in greater amount than solid bone transplants.

4. Callus grafts persist as long as solid bone grafts, and become quiescent at about the same time.

The writer is indebted to Dr. E. R. Clark of the Department of Anatomy of the University of Georgia for suggesting the problem, and for criticism of the work; also to Dr. Robert Terry and Dr. Edgar Allen of the Department of Anatomy, Washington University, for furnishing the writer with the necessary equipment and assistance in completing the paper.

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# OPERATION ON THE NECK OF THE FEMUR FOLLOWING ACUTE SYMPTOMS IN A CASE OF OSTEOCHONDRITIS DEFORMANS JUVENILIS COLE (PERTHES DISEASE)

B. GOLDBER, LEWIS McWHORTER, M.D., PH.D., F.A.C.S., CHICAGO  
Department of Surgery, Rush Medical College

**T**HE following case is reported because it adds some evidence to the theory of infection as a cause of the disease entity best known as osteochondritis deformans juvenilis, or Calvé Legg Perthes disease.

R. H., age 6 male entered the Presbyterian Hospital April 6, 1921 in the evening.

**Present complaint:** Patient lumps on the right leg has had pain in front of the right thigh, and temperature of 100.5 degrees for the last days. The father states that the child was perfectly well up to yesterday morning 36 hours ago. On waking up this morning he complained of being tired and slept until noon. In the afternoon he complained that his leg hurt him in the upper part of his right thigh. The parents noticed that when the boy walked, he limped and spared the right leg. The boy was put to bed early and slept well. This morning he complained of pain in the right thigh on attempting to walk so that he did not care to move about very much. He complained more of getting up and sitting down. The pain and disability have been growing worse.

**Previous illnesses:** eruptions and pertussis in 1919, chicken pox in 1920. One and one-half years ago the child developed an acute right sinus maxillary infection, had exposed to scarlet fever contracted by a brother, but he did not develop scarlet fever. At irregular periods since then he has had treatments for both sinuses. There has been intervals a discharge from the right nostril, with very disagreeable odor. One year ago he broke his nose. About 8 months ago his tonsils and adenoids were removed. The doctor who operated stated that at that time he drained an abscess of the septum of the nose. The micro organism found in the abscess and later in the maxillary sinuses was the staphylococcus aureus. Otherwise the patient has been well and has always been well nourished.

**Family history:** Parents, living and well to brothers well. A negative history.

**Physical examination:** The patient is a white, unimpaired, well developed and well nourished boy. Head and neck, negative to the general examination. No nasal discharge at present. Lungs and heart, negative. Abdomen, negative.

**Extremities:** Left leg normal. Right leg limitation of function at the hip, limitation of abduction, flexion, and rotation of the thigh by muscle spasm. The right groin looks fuller than the left and the thigh looks larger. On measurement the right thigh

at the groin measures 1.5 centimeters larger than the left. The lengths are equal. There is definite point of tenderness in the region of the neck of the right femur anteriorly and posteriorly. There is tenderness over the upper part of the thigh. When asked about the point of pain, the child points to the region of the hip and upper part of the right thigh. The white blood count was 9,000. Urine, negative. Temperature on entrance 100.4 degrees, and pulse 100.

A diagnosis of early acute osteomyelitis of the neck of the femur was made.

**Operation:** The patient was operated upon about 11 o'clock on the evening of entrance with anterior arthrotomy of the right hip. The capsule was opened and a clear fluid ran out. Cultures of this were taken. A small opening was chiselled into the anterior of the neck of the femur as far from the epiphyseal line as possible. The opening was enlarged with a curette and some spongy bone removed for culture. No gross pus was seen. Two strips of gutta serena were placed in the joint for drainage and one strip of iodiform gauze. A few silk worm sutures were put in.

A second incision was made over the lateral shaft of the femur about 4 inches down from the great trochanter and a small opening cut through the cortex. The bone appeared normal. Cultures were taken from the medulla.

**Postoperative course:** The temperature was 101.4 degrees the following day. It gradually fell, reaching normal on the fourth day. On the fifth day the temperature jumped suddenly to 104 degrees but went down to 100 degrees and the following day to 100.5 degrees and then went down to 100 degrees. Three days later it had gradually returned to normal and remained there. The material curetted from the neck of the femur cultured on blood agar plates showed one colony of staphylococcus aureus after 48 hours. Cultures from the joint fluid and the shaft of the femur were sterile.

Roentgenograms of the femur were taken 1 day after operation (Fig.). The head of the right femur appears to be flattened and broader than the left. The epiphysis is not uniformly dense to the roentgen rays. The decreased density is more

marked on the upper and outer side with increased density in the center. The inner side is more flattened, thin, and is quite irregular. There is consequently an irregular epiphyseal line. The inner portion of the epiphysis appears to be infringed upon and almost fragmented. Beneath this there is a prominence of the metaphysis. The neck is somewhat broadened, which may be due to an encroachment of the epiphysis laterally on the neck of the femur.

There is an area of decreased density in the neck near the intertrochanteric line. A second area of decreased density is in the shaft about 4 inches down. These areas are the result of the operation. The area on the shaft of the femur does not show in the reproduction (Fig. 3). There may be a slightly increased distance between the head of the right femur and the acetabulum as compared to the left side. The acetabulum, on careful inspection and measurements on this film, apparently slightly widened and the center somewhat flattened and more shallow.

Twelve weeks after operation the infected areas were examined as a possible cause of the trouble. Both areas are involved at that time, especially the right one. *Staphylococcus aureus* being found. They are treated by irrigation. The wound over the shaft of the femur healed by primary union. There was some discharge from the wound over the hip, but there was no discharge when the patient left the hospital apparently well. On the twentieth day after the operation. There was good motion of the hip, the femur could be moved in all directions, and the boy was able to stand on the leg without pain. However the parents were instructed to keep him off the leg for two weeks and then not to let him walk much for more weeks.

At the end of the month he was walking well and without any complaint. On examination twelve and a half months after operation there was no evidence of limp nor complaint of the leg. The roentgenogram in Figure 3 was taken seven months after operation. The inner portion of the epiphysis appears thicker, the base straighter and the top smoother than in the first roentgenogram. The irregular epiphyseal line appears at right angles. There are still present triangular or cup shaped areas of rarefaction in the metaphysis with their bases toward the epiphyseal line. The femoral neck appears thicker and more square than the other side. The patient has been under observation from time to time ever since the operation. Careful measurements made one year after the operation showed no evidence of disturbance of growth of the legs. Measurements were made of the lengths of the legs, the circumference of the thighs at the groin, at the middle and also at the distals of the legs. There was no difference in the legs. There was no difference in the motion of the two hips in any direction.

Eighteen and one half months after operation the boy fell from the wall of a partially built house and



Fig. 3. Eleven days after operation. The center of the epiphysis is more dense than the surrounding rarefied bone. The base of the epiphysis is irregular and encroaches laterally upon the neck of the femur. The neck appears somewhat broadened and shortened. The acetabulum may be slightly widened and flattened.

struck on his right hip. Following this accident he limped a little for about 3 days and then played and ran about again as usual. On careful examination there was no fever or evidence of injury. The roentgenogram Figure 3, was taken at this time. The epiphysis is more developed and the changes are not quite so evident, but there is an area of the center of the epiphysis somewhat saucer shaped near the articular surface which is rarefied and the border is more dense. The epiphyseal line is still irregular and former changes may still be observed.

There has been no abnormal symptoms since the operation and the patient has been under constant observation for three years.

This case illustrates an acute inflammatory condition. Clinically the symptoms appeared to be those of an early acute osteomyelitis of the neck of the femur. In early cases of osteomyelitis with foci in the metaphysis the focus is quite small. By establishing drainage in the outer portion of the neck in order to avoid injury to the epiphyseal line a small focus with gross pus may not always be seen. Only the one colony of *staphylococcus* was grown from the material removed from the neck of the femur. The cultures from the shaft of the femur and joint fluid were sterile.



Fig. 2 Seven and one half months after operation. The changes in the epiphysis and metaphysis are not quite so marked. The epiphysis is more flat than normal, the line more irregular, and there are changes still present in the metaphysis. The surface outline of the head appears somewhat worn eaten. The central part of the epiphysis appears more dense.

The presence of acute inflammation in the region of the hip is evidenced by the high leucocyte count, fever, the local findings and the clinical history with the absence of a history of trauma. There are several possibilities as to the location of the inflammation. There may have been a focus of infection in the neck of the femur near the epiphyseal line resembling a Brodie's abscess, or a low grade osteomyelitis. I made no effort to approach the region of the epiphysis or to demonstrate gross pus on account of the short duration of symptoms. The findings and the post-operative course are compatible with other cases I have seen where tension has been relieved with drainage of very early acute small osteomyelitic foci in the neck of the femur. They are also compatible with the drainage of a Brodie's abscess which may heal without prolonged or even any suppuration, as Dr. Bevan has shown in his treatment of these cases. Cultures taken from these abscesses are often sterile. In this case the limping disappeared completely as soon as could be expected after an arthrotomy on the hip joint, and the patient was walking



Fig. 3 Eighteen and one half months after operation. There is a saucer shaped area of rarefaction at dense border in the center of the head. The epiphysis now still irregular and former changes may still be observed.

normally within a few weeks—a circumstance which does not conform to the usual course of Perthes' disease. Since there have been no other symptoms at this late date, over 3 years afterward it may be inferred that the operation favorably influenced the disease. This might be explained by relief of inflammatory tension in the metaphysis from the osteotomy of the neck of the femur.

The location of the inflammation may have been limited in the epiphysis. The microscopic evidence in the case operated upon by Phemister proves that this may be the site of inflammation in Perthes' disease. Phemister is of the opinion that the history and roentgenograms of this case corroborate his theory of inflammation with a probable origin in the epiphysis.

The acute symptoms may have been due to an acute synovitis due to an extension from a focus of infection in the epiphysis or metaphysis.

It is possible that the Perthes' disease predisposed to the development here of a metastatic synovitis or arthritis from the focus of infection in the nose.

It is also possible that the acute symptoms were due to an exacerbation of the inflamma-

tion in the epiphysis which had extended through into the metaphysis. This last possibility would concur with Phemister's theory of origin in the epiphysis.

A review of other cases of Perthes disease operated upon and also a consideration of cases associated with an acute inflammatory condition are of interest to compare with this case.

The recognition of this condition as an entity may be credited to Calvé, Legg and Perthes. Previous to the time of recognition these cases were described under the headings of arthritis deformans juvenilis and mild tuberculosis of the neck of the femur (Perthes, Waldenstrom).

It is characterized by occurrence usually between the ages of 5 and 10 years. It is more common in boys. The earliest sign is usually a limp inaddious in its development with little discomfort. In some cases the onset is more acute. There is usually limitation of motion especially abduction. After a variable period of several months there is a steady and usually complete subsidence although careful examination may show a slight residual limitation of mobility. In some cases there may be shortening of the leg. At any time during and even after the phase of active symptoms the hip joint shows a cycle of osseous changes peculiar to this disease. These consist of a distortion and flattening of the head of the femur. There is usually a stage when the epiphysis appears fragmented. A broadening and stunting of the femoral neck may be seen to a greater or less extent. There may also be changes in the acetabulum, which Platt believes are due to the adaptation of the cavity to the altered lines of pressure through the deformed head and similar to the changes in the epiphysis and thus truly specific. On the contrary Jansen believes that a flattening and enlargement of acetabulum occurs first and that the flattened head results from the flattened socket.

Five other surgeons have operated upon a total of eight cases of this condition.

Perthes operated upon a case removing specimens for examination. The external surface of the cartilage of the head appeared

smooth but flattened. Microscopic examination of the piece from the head showed numerous isolated islands of cartilage between which were bone cells. He found no evidence of inflammatory infiltration. A piece of synovia showed no changes on examination.

Legg operated upon and curetted a septic focus in the neck of the femur through the great trochanter. A staphylococcus growth from the necrotic material was obtained. He believed it improbable that changes in the head were due to infection of the neck, since in many cases of known infections of the neck there are no similar changes in the head. He considered trauma at the epiphyseal line producing a circulatory disturbance as the cause. Allison and Moody failed to produce a condition similar to this experimentally by trauma of the epiphysis in rabbits. Adams says in young children a much larger portion of the epiphysis is nourished by the artery through the ligamentum teres, but as the child develops more of the circulation comes from the posterior reflected capsule which runs up back of the neck.

Kidner has operated upon four cases. His first case in addition to typical roentgen changes in the head showed a large single subepiphyseal cavity with a distinct wall resembling a bone abscess of a low grade infection. One or more areas of absorption may be seen in the neck of the femur in the roentgenograms of many other reported cases although no other cases which show these areas have been operated upon. Kidner drilled through the greater trochanter under the fluoroscope and curetted the bone. Cultures showed staphylococcus aureus of low vitality. The hole was filled with bone wax and closed tightly. Recovery was uneventful. Six months later motion was practically normal and there was no shortening of the leg.

Recently Kidner reports that he has operated upon three more cases of Perthes disease because the patients had acute symptoms for a period longer than usual. These cases were still under treatment by fixation. One had vacuoles outside the epiphyseal line one had what he thought was an acute osteomyelitic cavity of the Brodie

## THE RESULTS OF SURGERY FOR MIGRAINE

Dr J ARTHUR DUCHYMAN, M.D. 315 S. PUEBLO, COLORADO  
Section on Medicine, Park's Clinic

**S**EVENTY-FIVE per cent of 1,335 patients were operated on from one to seven times for the relief of migraine.

The histories of this large number of patients furnish data which are valuable for estimating the end results of operations for the relief of migraine. The operations were performed by surgeons all over the United States and varied in magnitude from cerebral decompression and colectomy to circumcision of the clitoris.

## SURGICAL FIELDS

All surgical fields except the orthopedic were invaded in an attempt to cure migraine by surgical measures. The nose and throat surgeon removed tonsils, spurs, polyps, and turbinate bones from the nose and removed destroyed, or treated the sphenopalatine ganglion. The ophthalmologist straightened tendons, and on one occasion trephined for glioma. The abdominal surgeon who limited himself to orthodox rules removed the gall bladder, the appendix, broke up adhesions so that more might form, performed gastro-enterostomies, and colectomies, while the gynecologist took away or repaired the reproductive organs. If the latter was venturesome he wandered into wider fields and did the same as the abdominal surgeon whereas the latter if venturesome removed or mutilated the reproductive organs to suit his fancy. The decompression was done by a general surgeon.

The end-results from all angles of surgical attack were the same. Not a single patient among those who were operated on was cured or relieved more than temporarily while those patients who were unfortunate enough to have their reproductive organs removed, or have a gastro-enterostomy formed were made much worse on the part of migraine as well as generally. In those cases where a gastro-enterostomy had been formed, the general health was partially or wholly restored to

the original status by the undoing of the gastro-enterostomy.

## THE BIOLOGICAL NATURE OF MIGRAINE

Migraine is a biological character of man characterized by paroxysmal attacks of pain, usually in the head, either unilateral or bilateral but occurring also in the abdomen, and associated with nausea, vomiting, mental depression, disturbances of sight, and many vague somatic disturbances. One or all of the symptoms may occur in an attack. The manifestations start first in early life and as a rule terminate during the fourth decade. The processes taking place before, during, and after the attack are entirely unknown.

In 1919, on material collected in the Mayo Clinic, it was demonstrated that migraine was transmitted through the germ plasm according to Mendel's two laws. All hereditary characters are transmitted from generation to generation as an integral part of the germ plasm of the individual who bears the character. The character forms a natural part of the life cycle of such individuals. Migraine occurs in man as a result of the integral constitution of his germ plasm and is the expression of a normal physiological status. The condition is not a disease because it produces an inconvenience to its bearer. The person bearing the migraine character is no more abnormal than a person with brown or blue irides. There is no departure from the natural course of life in order for the migraine character to express itself. It is physiological for persons to have different colored irides as well as a goodly number of other characters, because of the constitution of the germ plasm, so that, if one character occurring in man as an expression of ancestral traits is normal, it naturally follows that any condition that is brought to a person through the germ plasm is also biological. It is the expression of the type of stuff of which the individual is composed.

## CASE HISTORIES ILLUSTRATING RESULTS OF SURGICAL MEASURES

The extreme of surgical measures for the cure of a migraine character is illustrated in Case 1 while the milder surgical maneuvers are illustrated in Case 2.

CASE (209) Mrs L O'D age 4, came to the Clinic on August 1, 1923 because of vomiting, retention of food, and sick headaches. Father suffered from sick headaches and died at 68 from apoplexy; mother and two sisters living and well. Husband living and well. The patient had no miscarriage at the fourth month, scarlet fever as a child, diphtheria in adult life, influenza in 1919, tonsillitis frequently and has fever from July 1 to September when living in Puerto Rico. The first surgical was performed in 1903 when the cervix was amputated. In 1913 a rectal operation was done for hemorrhoids. In 1917 an appendectomy was performed. In 1921 gastro-enterostomy was made and adhesions broken up. In 1923 gastro-enterostomy was undone and adhesions broken up again, but this latter was done to make it possible to arrive at the operative field. The trouble began in early life with periodical headaches. The headaches were preceded by a short interval by black spots in front of the eyes. They were unilateral or bilateral frontal, and were relieved only by vomiting. The attacks would last part of the day and at times days. The headaches at the beginning occurred infrequently but gradually increased to once each week. During the year before admission to the Clinic the attacks had occurred more often than once a week. During the year before the gastro-enterostomy she had had good deal of domestic utility and an irritable stomach began to show signs about 1 to 2 hours after eating. She was advised that all symptoms would be relieved by a gastro-enterostomy. After the operation the headaches continued unabated. In addition to the symptoms which she had had before operation she now became troubled with vomiting with and without headaches, and food was retained in the stomach as long as 14 hours. Because of constant loss of weight and inability to retain any food except liquids, she was advised to have the gastro-enterostomy undone. The operation and convalescence were uneventful. The headaches continued to occur but the general health was gradually improving.

The five operations to which this patient has been subjected have only tended to debilitate her generally and have had no good influence on the primary condition.

CASE (36) Miss J R B age 3, came to the Clinic on May 15, 1920 because of sick headaches. Father and mother living and well. One brother has

sick headaches. Four sisters living and well. One sister died in infancy. Father had sick headaches which stopped during the fiftieth year of his life. Paternal grandfather had sick headaches. One sister of father had sick headaches. Two sisters and two brothers of father were free of headaches. The patient had tonsillitis as a child, and malaria when 4 years of age. The menstrual history was negative. When about 5 years of age she began to have sick headaches. The attacks came once or twice a year and lasted from a day to one and one-half days, and were associated with vomiting and general bodily distress. This kept up until years before admission when she began having headaches every week. The attacks usually came late in the afternoon, and lasted during the night. The pain was located over one eye as a rule, but occasionally at different parts of the head and back of the neck. The attacks usually were severe enough to stop further work for the day. Preceding the onset of pain the patient experienced a sense of all gone, Scotomata did not precede the attack. The attacks were sometimes relieved by vomiting. For the relief of these symptoms the patient had an appendectomy in the spring of 1913 and a tonsillectomy in November 1913. The operations had no influence on the course of the trouble.

## COMMENT

The histories of the two patients presented illustrate exactly the end results of surgery for migraine. The minor assaults to destroy foci of infection in teeth, tonsils, gall bladder, appendix, and so forth are all valueless. A new chapter in medicine may be written by surgeons not operating on patients for the relief of migraine. Persons with migraine are not so far as knowledge is available exempt from any disease occurring in man.

## SUMMARY

1. Migraine is hereditary in man and is transmitted from generation to generation according to the laws of Mendel.
2. Surgical procedures have no place in the therapy for migraine.

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# CYSTINURIA A COMPREHENSIVE STUDY WITH REPORT OF AN INTERESTING CASE

By AUGUSTUS HARRIS, M.D. FACS BOSTON NEW YORK

**M**ISS M. B. age 16 referred by Dr. J. Schroeder came to my office complaining of pain and soreness in both flanks, more marked on the left side. She was of a distinctly neurotic type, the speech was hesitant and she was very slow in responding to questions. There were no urinary symptoms.

**Previous history.** Bowels somewhat constipated. She had been thoroughly studied for 3 weeks in one of our leading hospitals and, after X-ray examinations of the gastro-intestinal tract, a diagnosis was made of chronic appendicitis with psychical epilepsy. A short time afterward her appendix was removed by a prominent surgeon in another institution. After 3 weeks she returned home. In 24 hours the severe abdominal pain compelled her to reenter the hospital where she remained for 4 weeks. At this time cystoscopic study led to a diagnosis of colon bacillus pyelitis (right side) with negative pyelography. Thereupon she passed considerable gravel over a period of 8 weeks.

After her convalescence from the operation, the pain persisted and she was referred to me because of the finding of some pus cells in the urine. She was immediately placed upon alkalies, forced water and highest acidophylus culture and, for a few days afterward, suffered three attacks of severe renal colic accompanied by slight rise of temperature and pyuria.

**Cystoscopy May 12, 1922.** No crystals were present. The ureteral orifices were normal. The bladder irritable but of normal capacity. The catheter passed to the right renal pelvis and with clear return flow of urine. The left catheter was completely blocked at a point 6 centimeters from bladder with scant return flow of cloudy urine. A wax tipped sili-form bougie passed to this point showed a definite scratch. **Diagnosis.** Ureteral calculus (left).

At the next examination the wax bulb confirmed the finding of scratch with the ureter was dilated to No. 1 and 14 F with bougie. The first uric sediment was found to contain many typical hexagonal cystin crystals.

On May 15 the ureter was dilated to No. 14 and 16 F and the obstruction was found to be only 1.5 centimeters from the bladder (Stone moving down).

On June 3, urine was clear, patient free from pain, left ureter dilated to No. 20 F as far as obstruction.

A few weeks later the patient passed a stone about the size of an olive pit. Since that time, however, the patient has suffered several attacks of severe colic, requiring morphine for relief. During and immediately following each attack there appeared

showers of cystin crystals in the urine. Over a period of a few months she passed four other stones varying in size from match head to a cherry pit.

**Chemical analysis** of one small stone by Dr. W. W. Hales showed pure cystin. The urine had been later muttily cloudy and, while she had suffered slight pain in the left side it had been notably less severe and less frequent and she was attending school almost without interruption.

On February 3 she suffered rather severe pain in the left kidney which kept her in bed for one day only. Symptomatic relief continued until May 17 when she had two more severe attacks of pain and the urine became turbid with pus. X-ray study revealed a stone in the pelvis of the left kidney about the size of a small English walnut, with right kidney negative.

On May 24, I operated upon the left kidney and removed the stone through a rather long preloster incision in the base of the erector. The kidney was carefully explored for evidence of other calculi or fine gravel, and the pelvis repeatedly irrigated. The incision in pelvis closed with No. 00 Catgut. The flaps were closed in layers and cigarette drains inserted for 48 hours. Convalescence was uneventful, the wound was completely healed by primary union in 10 days, and the patient left the hospital in good condition on the thirteenth day.

The stone was bean-shaped and of yellowish brown color rather than greenish yellow as usually described. Also the tone was rather hard but somewhat friable and the crystalline deposits on the rough side toward the calices, could be clipped off with the finger. Under lens the surface was uniform throughout, and chemical analysis by Dr. W. W. Hales revealed pure cystin with very minute quantity of calcium phosphate and blood. Fragments were dissolved in 10 per cent ammonium hydroxide solution and allowed to crystallize. They showed clusters of the clear hexagonal crystals as they appeared in showings in the urine.

We have kept the patient on a low protein diet with mostly vegetables and given her 35 to 55 grains of bicarbonate of soda three times a day intermittently. We were cautious to avoid the danger of alkalis by giving rest periods between the alkali therapy. She has drunk quantities of distilled water. The patient confesses recently to taking a square meal with meat two or three times weekly.

Up to the time of the last operation she had been having renal colic treatments with intrate of silver every 4 to 6 weeks. The object of an ongoing chronic pyelitis in so far as possible. The urine from the right kidney had almost always been clear and latent. The renal lavage of the left had been accom-

phased by passing both full sized catheters to the left pelvis whenever the urine contained pus.

In spite of diet, alkali therapy and other measures, each analysis showed some cystin crystals, but on the other hand, clinically, the patient had obtained marked symptomatic relief over a period of several months. How long this case will be spared from the recurrence of calculi is entirely a matter of conjecture and we are concentrating our efforts along this line. The writer hopes to conduct some experiments at a later date.

#### GENERAL CONSIDERATIONS

From several viewpoints I became greatly interested in the case reported and I concluded to make a thorough study of the literature concerning this rare condition. I was more particularly impressed in the beginning of treatment with the repeated tendency to form stones and my consequent helplessness in affording lasting relief to the patient.

After this study I am convinced of the lack of positive knowledge in regard to the production of cystin in the body and in the urine. All sorts of divergent theories are promulgated. All are agreed that cystin is an intermediate product of protein metabolism, but the production of cystinuria is not understood. The work of the biochemists carries us into endless animal and human experiments with intricate chemical processes most confusing to the clinician. The substance is an amino acid, containing about 25 per cent of sulphur and is often accompanied by the diamines leucine, tyrosine, putrescine and cadaverine, etc.

In a recent case reported by Macalpine the urine emitted a very foul odor apparently due to liberation of sulphur as sulphuretted hydrogen. A careful search for putrescine and cadaverine was unsuccessful.

In cystinuria it has been shown that it comes from the tissues of the body since cystin given in the food does not increase the amount excreted. Theories point to possible disturbances in the tissues, lungs, intestines, kidneys, and liver. Certain it is that cystin plays a leading rôle in the production of bile. Cystinuria is always increased on a mixed diet containing abundant nitrogen and sulphur. Conté's study of two cases with articular rheumatism always showed an increase on shifting from a milk to a meat diet, and the amino-

acids were always diminished in the periods following the showers of crystals in the urine. The hepatic and renal function tests were always negative and the daily quantity of cystin was not in proportion to the amount of urine passed. The urinary sulphates were diminished during the elimination of cystin. Blum found that the flooding of the intestines with cystin even to the point of toxicity failed to produce cystinuria.

Von Bergman, Marowaki and others reported observations pointing to the liver as the source of cystin. Cystin is notably essential to nutrition and growth as shown by the experiments of Osborn and Mendel. They fed rats with raw navy bean which produced malnutrition from absence of cystin. Sondern reported that intensive dietetic studies of cystinuria failed to yield practical clinical results. He expressed himself that cystinuria may be the fault of hepatic function. Alsberg and Folin failed to eliminate cystin from the urine of a case fasted for 13 days with practically no protein at all. Thiele also found the elimination of cystin to be independent of diet.

Jacoby and Klemperer reported marked success in eliminating cystin from the urine with relief from renal colic by giving sodium bicarbonate internally and a vegetable diet. In this connection Prof. A. Neuman and later Rosenfeld reported some success in controlling the cystin in the urine under this treatment, but both these writers stated that the effect was only temporary and they could not control it satisfactorily. Conté reported similar results with proper feeding.

Baumann and Preusse produced artificial cystinuria in dogs with bromide chloride or iodide of benzol with acetylcystine.

Garrod considered cystinuria an arrest rather than a perversion of metabolism.

Cystinuria is, indeed, a rare condition and has been reported by some to be present once in 20,000 analyses, by others once in 35,000. In spite of its rarity I believe that there are many cases which may be overlooked or which are not reported in the literature. However, a well-known pathologist of wide experience in this city does not recall having seen a case. I know of two other recent cystinuric patients, one having had arthritic symptoms



and without urinary symptoms a female patient of Dr L. S. Mullin. The other case was a male age 40 who had suffered three attacks of renal colic over a period of 18 months. Skilagraphy was negative and Dr S. L. Fisher reports that there has been no recurrence of symptoms during the past 3 years. The total number of cases reported approximates 140 over a period since 1810, when it was first described by Wollastan. He erroneously called it cystic oxide from kystis (bladder) following examination of a bladder stone.

The condition occurs at all ages and in both sexes, but is notably more prevalent in the male and in young adults. Rosenstein reported as many as 45 stones removed from one patient.

There are many contradictory statements as to the tendency of cystin to form calculi but I believe it is the consensus of opinion that stones are likely to form because of the insolubility of cystin. Some have reported cases associated with distinct arthritic symptoms and a few with uricæmia.

It has also been noted that many cystinurics are of a distinctly neurotic type. This fact was striking in the writer's case. There is a strong family tendency to this condition as repeatedly shown. Kretschmer reported a case in twin boys of 9 years each with vesical calculi which he successfully removed by litholapaxy.

Another point of especial interest in cystin calculi is their penetrability to the X-ray. In the older literature there is but little accurate information. There seems to be a prevalent but erroneous idea that cystin stones are not opaque to the X-ray. Some have declared that they are not shadow-casting others that they are very dense. Taking all the limited data on the subject, it appears that most cystin stones are shadow-casting. However in recent years Graves reported a case which he diagnosed by the wax tipped bougie and in which the pyelogram revealed the stone as an area of diminished density. Removal of this stone and analysis proved it to be cystin.

Henry Morris, in a careful study demonstrated to his own satisfaction that these stones are opaque to the X-ray. In 1906 he collected 21 of these stones from the Museum

of the Royal College of Surgeons. The stones were of different sizes and from different parts of the urinary tract, six having required surgical removal.

Wolf Klenock, and Neuman have also cited experiences with shadow-casting cystin calculi.

Graves experiment to test the penetrability of cystin stones to the X-ray was not a fair one. He gave capsules of pure cystin internally and also capsules of bismuth for comparison, and found that no shadow appeared from the cystin capsules. This is very different from the actual calculi, and, as Arcelin points out the opacity of a calculus is determined by the thickness and structure as well as by the composition. One may be compactly the other loosely held together.

In regard to the marked tendency in some to the reformation of stone a striking case is reported by Dr A. Mueller of Berlin, who followed a case from 1902 to 1909, during which time he performed four nephrotomy operations and one litholapaxy in a young man. In this case X-ray examinations were repeatedly positive.

History shows that analyses of most of the stones which have been removed are of pure cystin composition, although some have been found to contain admixture of calcium phosphate or oxalate, or ammonium or magnesium phosphate.

A recent case of interest is that of Tennant (1923) in which 12 stones were removed from the right ureter, one large stone from the right kidney and another from the left kidney. This required three major operations in a woman of 31 years.

When we stop to consider these facts, we are impressed at once with our helplessness in controlling the reformation of calculi in the urinary tract. This applies not alone to cystin but the other forms, like oxalate, uric acid, or urate. It is a problem of tremendous importance to urinary surgery. It is worthy of note also that analysis of most calculi reveals the fact that their composition is mixed.

The writer believes that, in the not far distant future, urinary calculi will become largely a medical rather than a surgical problem. We hope to see our knowledge of diet nutrition

and metabolism grow to that point where the underlying chemistry will be well understood and the formation of crystal showers, gravel, and calculi prevented.

In this connection however Thomson Walker states that the excess of crystalline formations is, in itself insufficient to produce calculi. It also requires a cement substance or insoluble colloid formed from fibrinogen or fibrin to hold the particles together. Just how this is brought about is not known. It is thought to be induced perhaps by inflammatory reaction from bacteria passing through the kidney in large numbers from the blood stream, or perhaps by the continued irritation of the crystals themselves.

A great deal has been said in recent years by prominent urologists of the part that urinary stasis and infection have to play in etiology of stone. While these are a factor in some cases, they do not appear to be important except perhaps in the alkaline phosphatic variety. It would seem, for example that where local infection is encountered with the presence of calculi in the urinary tract the stone was the antecedent and producer of the infection rather than the result of it. However who knows but what an unrecognized symptomless bacteriuria from focal infection streptococci may have preceded all these? As far as pyuria is concerned we often see it accompany the renal colic and disappear between attacks.

Again the urinary stasis produced by obstructive lesions in the urinary tract, to my mind plays a minor part except in phosphatic types. I believe that this is illustrated in the many cases of calculi not accompanied by filiform urethral stricture or prostatism, or ureteral stricture or kinks. Then, too in hydronephrosis where it is accompanied by stone it is usually found that the calculus has blocked the mouth of the ureter and produced the obstructive lesion rather than resulted from it.

If infection plays any part at all, it is largely blood-borne with a certain specificity. This is illustrated in the every-day case of chronic renal tuberculosis where pus is poured out in quantities often for long periods without forming calculi except in rare instances. A most

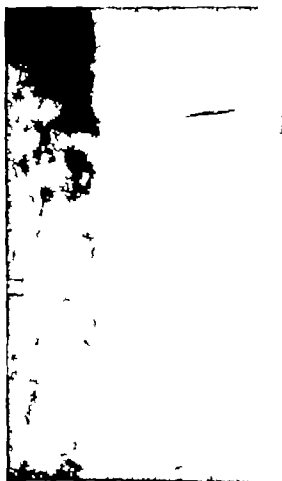


Fig. Roentgenogram of left kidney showing cystic calculus in pelvis, also outline of kidney.

interesting piece of work in regard to elective localization of bacteria and their relationship to urinary calculi was recently done by Rose now and Meissner of the Mayo Foundation. They infected the teeth of six dogs with streptococci recovered from the urine of a patient with nephrolithiasis and in all of the five dogs which lived urinary calculi developed. None of the control cases infected with other strains of streptococci developed stones.

In 1919 Dr A. J. Ochsner reported striking results in the prevention of recurrence of renal and ureteral calculi by having the patient drink only distilled water. This appeared logical in that it eliminated the lime salts. It is a well known fact that stones are more preva-

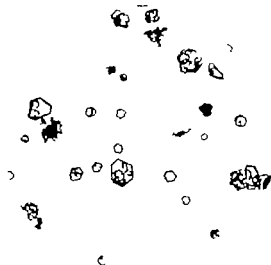


Fig. Photomicrograph, showing clusters of hexagonal cystin crystals as they appeared in solution in the urine specimen obtained by dissolving fragment of stone in ammonium hydroxide solution (Courtesy of Dr Archibald Murray)

lent in limestone regions, as in India. A boiler-maker patient of Dr Ochaner's suggested this method to him and stated that his colic had been entirely relieved in this way. The patient said that he had eliminated clogging of the boilers with lime in the form of scales and thought that it would be good for the kidneys. Since that time however a number of cases of calculi have been reported in patients who drank only distilled water. In this connection however we must consider how often stones are multiple small and overlooked at the operating table with almost immediate recurrence of symptoms and positive skiagraphy. There are some surgeons who believe that recurrence after operation is as high as 50 per cent. With renal lavage antiseptic therapy and other measures for control of urinary infection we are attacking only one side of the problem as far as calculus formation is concerned. Even with the removal of obstructive lesions of the urinary tract from top to bottom and also the removal of all demonstrable infection foci it would appear that calculi will continue to form. Only a more complete knowledge of the body chemistry will carry us to a point where calculi will be largely pre-

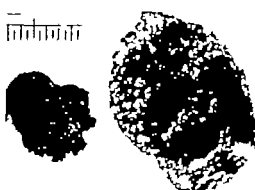


Fig. 3

Fig. 4

Fig. 3. Photograph of cystin stone removed from pelvis of left kidney. Size of stone somewhat reduced by crushing of crystals before photograph was taken.

Fig. 4. Magnified photograph of cystin stone showing uniform crystalline deposits throughout (Courtesy of M. F. H. Humphries).

vented and not recur after one or more major surgical operations have been performed. This involves not only a surgical problem as before intimated but an intricate medical problem for prophylaxis.

Concerning the strong hereditary tendency in cystinuria, I have carefully examined the urinary sediments of the various members of the family with the following results:

Mother 53 years negative

Father 63 years negative

One sister 25 years negative

One sister 27 years negative

One brother 29 years ovaluria

One brother 31 years ovaluria

One brother 33 years heavy cystinuria and ovaluria. This brother has suffered a great deal with severe head aches and is said to have had kidney trouble in childhood.

One brother 14 years showed cystinuria

Had several attacks of rheumatism but had no urinary symptoms.

It is to be noted, therefore, that two other members of the family have cystinuria (brothers) one of them with a definite rheumatic history the other having a distinct ovaluria associated with cystin. Two other brothers also showed a marked excess of ovalates. I am not certain as to whether any other observers have found ovaluria associated with cystin or in members of cystinuric families.

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## DIAGNOSIS AND TREATMENT OF GASTROJEJUNOCOLIC FISTULA

B. WILLIAM A. BRAVIS, M.D. AND KARL A. MEYER, M.D. F.A.C.S. CHICAGO

From the Department of Radiology and Pathology, College of Medicine, University of Illinois, and the Cook County Hospital

THE surgical treatment of gastric and duodenal ulcer has recently gained wide acceptance because of the excellent results reported from American and foreign clinics. This has resulted in an accumulation of a great literature on the technique and results, and complications following this form of treatment.

It is not the purpose of this paper to discuss the various methods of operation but rather to lay stress on certain of the complications which may follow operation for ulcer, namely gastrocolic and gastrojejunal fistula. This phase of the subject attracted our attention because in a series of 127 operations for gastric and duodenal ulcer performed by one of us, gastrojejunal fistula occurred twice within 6 months and because early recognition and prompt radical treatment resulted in a cure.

Fistulous communication between the bowel and stomach due to various causes has been studied by Bec (3) who found 62 cases reported up to 1897 and who classified the causes as follows:

- 1 Gastric causes: Carcinoma, 35 cases; ulcer, 12 cases; tuberculosis, 1 case.
- 2 Extragastric causes: Carcinoma of the colon, 8 cases; abscess in the peritoneal cavity, 5 cases; congenital fistula, 1 case.

Port and Reizenstein (17) found but 95 cases up to 1907 and Voorhoeve (22) found 105 cases from all causes up to 1912. To this group must be added the case of traumatic gastrocolic fistula reported by Le Noir, Haret, and Desbouis (3) following multiple stab wounds of the stomach and intestines.

In 1920 Bolton and Trotter (4) collected 27 cases of fistula between the stomach and intestine following operation for ulcer and added four of their own. Since that time 14 more postoperative cases have been reported making a total of 45 up to the time of the writing of this article.

In studying the reported cases following operation for ulcer as well as those due to

other causes, we were impressed by the fact that all but one of the patients were males and that the majority were between the ages of 30 and 50.

The type of operation performed for the original ulcer seemed to be of minor importance as the fistula occurred after posterior gastro-enterostomy with and without pyloric resection and Linhart (14) reported an instance after a Roux intestinal anastomosis. The symptoms began in from a few weeks to 9 1/2 years, but usually within 1 year after operation. It is of importance to note that the colicoides closely with the time gastrojejunal ulcers begin to show symptoms. There seems little doubt that a gastrojejunal ulcer is the forerunner of a fistula and that the prevention of the one will prevent the other. It is also of interest to note that Rankin and Mayo (19) estimate that gastrojejunal ulcer occurs in from 1 to 3 per cent of patients after operation for gastric or duodenal ulcer.

The clinical signs are characteristic in a well developed case but instances are on record in which recognition was difficult or impossible. Thus Aron (1) reported a case in a man in whom the course was clinically latent and in whom the gastrocolic fistula was found accidentally at autopsy. Others (Frankau 9, Burnham 5, Saar 20) have reported cases with sudden onset while Firth (6) described an instance in which gastrocolic fistula was the first manifestation of a previously existing ulcer. In the majority of cases, however, there were symptoms of gastrojejunal ulcer for some time before the clinical manifestations of fistula developed.

The clinical symptoms and signs of fistula between the stomach and intestines are quite characteristic, although one or more of these manifestations may be absent. Perhaps the most characteristic sign except that provided by the X-ray is fecal vomiting upon which manifestation alone a diagnosis may be made if other signs of ileus are absent and especially if there is a history of previous



Fig. Roentgenogram of Case 1 showing large defect at the great curvature of the stomach and two sac-like projections in the jejunum near the point of its attachment to the stomach in gastro-enterostomy operation. The barium entered the rest of the jejunum through the segment showing the two sac-like deformities. A direct communication between the stomach and colon or jejunum and colon was seen.



Fig. Roentgenogram of Case 2 showing barium meal entering the distal half of the transverse and the descending colon from the stomach via a very small segment of jejunum, illustrating the almost direct communication between the stomach, jejunum, and colon and thus proving the existence of a fistula.

operation for gastric or duodenal ulcer. The vomitus may resemble the stool contents and Arons (2) reported a case in which formed fecal masses were found in the vomitus. *Diarrhea* which is persistent, appearing periodically or continuously is a valuable symptom and may be the first manifestation of a gastrojejuno-colic fistula. The stools are yellow or grayish soft and acid and contain much undigested food, especially meat fibers and fat. Excessive fat in the stools is considered by Strauss (21) as suggestive of fistula if other conditions, especially pancreatic disease, can be ruled out. The rapid passage of the food through the gastro-intestinal tract within 2 to 3 hours in a case reported by Goldschmidt (10) no doubt plays an important rôle in the marked loss of weight and strength so commonly seen in these patients.

Another important sign and one which may clear up the diagnosis, even if the condition is not suspected is provided by the X-ray. This method permits the actual visualization of the fistula. But it is also important to remember that some fistulas have a valve-like formation at the site of communication so that a contrast meal may not show the condition while a barium enema easily discloses the fistula (Groeschel, 11) or the fistula may be seen at certain examinations and not at others (Haudeck 12 Falta 7). A procedure suggested by Holzknecht was to inflate the rectum with air and to note the rapid increase in size of the stomach bubble.

Other diagnostic measures which have not been employed so commonly but which may help in clearing up the diagnosis are to give a suspension of charcoal, methylene blue (R.

Neumann 16) or carmine per rectum and to recover these from the stomach by lavage in from 1/2 to 1 hour. Pratt (18) described the disappearance of lavage water from the stomach in the manner sometimes seen in hour glass stomach, and J. Marmoch (15) reported an instance in which the X-ray was negative but in which water given as an enema was found in the stomach.

The foregoing study of the literature also revealed that 14 of the 45 or 31 per cent of postoperative cases of gastroduodenal or gastrojejunal fistula occurred in the last 255 years. The addition of our 2 cases to this series raises the rate to 35.5 per cent in the last 30 months. It is this rapid increase in frequency together with the complete cure attained in both of our patients by radical surgical treatment that has prompted us to publish the following two cases.

**CASE 1:** H. R. male age 41 clerk admitted to the Cook County Hospital on April 11, 1913. He had been ill for 25 years with severe epigastric pain, belching, vomiting and weakness. Gastroenterostomy was performed 6 years ago with relief of symptoms for 3 years, but then another operation was performed with original ulcer as found healed but another ulcer had formed at the site of the gastroenterostomy stoma. The past few weeks had become almost continuous, and was not relieved by food or local warmth. Vomiting sometimes occurred after the onset of the pain. There was considerable loss of weight and no improvement after 6 weeks course of sippy treatment.

Examination revealed emaciated male with tenderness in the right hypochondrium and under the right scapula. No rigidity or masses were found. The stools contained blood. On the benedictine test. The stomach contents after a Ewald test meal showed free hydrochloric acid 57 total acidity 49. The urine was negative. The Wassermann of the blood was negative. The X-ray with barium enema showed a narrowing of the transverse colon just to the left of the midline and poorly filled ascending colon. The X-ray of the stomach showed defect at the greater curvature. The duodenal bulb as irregular. The gastroenterostomy as not looking well. No fistulae were seen. Two small sacs were constantly present in the jejunum near the point of attachment to the stomach. These sacs are suspected of being jejunal ulcers.

The following pathology was found at operation. The site of the original ulcer was indurated but microscopic examination showed that the process was benign. This healed ulcer had produced pyloric stenosis. There were found the remains of the pos-

terior no loop gastro-entrostomy. The gastrojejunal ulcer at the margin of one. This gastrojejunal ulcer had perforated into the colon and communication about 3 centimeters in diameter connected the stomach, jejunum, and colon.

The operation consisted of resection of the ulcer bearing portion of the stomach so that about one third of the pyloric portion of the stomach was removed. The gastrojejunal ulcer was resected and a end to end duodenojejunojejunostomy as performed. A long loop gastrojejunostomy was then made and the stomach and bowel were sutured with interrupted catgut. The X-ray examination, weeks after operation, showed that the new communication between the stomach and bowel as functioning in a satisfactory manner. The patient rapidly gained in weight and the general condition improved greatly. He left the hospital without dyspeptic symptoms and apparently cured.

**CASE 2:** T. L. age 41, male, white, admitted to the Cook County Hospital on June 30, 1913. He had complained of epigastric pain for many years until he suddenly developed a perforated gastric ulcer for which he was operated upon 4 years ago. Six months later he was again operated upon for pyloric obstruction after which he remained free from symptoms for the next 3 years. He then developed severe epigastric pains after meals. The pains were partially relieved by soda. Vomiting occurred occasionally after meals. Severe diarrhea set about 3 or 4 years. The stools were of light color, soft or liquid, contained no gross blood and he had about six bowel movements daily. He was relieved but little after a strict course of sippy management.

Examination revealed the following. The teeth were in poor shape, the pupils normal, and the chest normal. The systolic blood pressure was 110 millimeters and the diastolic 80. There was some tenderness in the epigastrium and over the liver but there was no rigidity. The liver reached 2 centimeters below the costal arch but no masses were found in the abdomen. The reflexes were normal. The urine contained trace of albumin and few hyaline and granular casts. The Wassermann of the blood as negative. The blood chemistry showed non protein nitrogen 3.0, urea nitrogen 4.0, urea 5.97, creatinine 4.4. The X-ray showed that the gastroenterostomy functioned well. The barium appeared in a few minutes in the transverse and the descending colon. Several minutes later the stomach seemed to fill again from some other source. A barium enema showed that a small segment of jejunum communicated directly between the gastroenterostomy opening and the upper part of the descending colon. This direct communication of the communication between the stomach, jejunum, and colon proved the existence of fistula at this point. Condition suspected when the diarrhea was noted before the operation for ulcer.

This patient was operated upon August 14, 1913. The abdomen was opened by median incision ex-

tending from the xij bowd to the umbilicus. There are dense adhesions around the duodenum and marked thickening of the wall of the gastroenterostomy. An exploratory incision was made in the stomach midway between the greater and lesser curvatures. The ulcer of the duodenum was found to be healed and the site of the gastroenterostomy opening was very thick but still patent. Another opening high led to the colon was found about 5 centimeters anterior to the stomach of the gastroenterostomy. This opening easily admitted two fingers. The mucosa of this site showed a few petechiae and thick layer of mucus. The muscularis was considerably thickened but the serosa was smooth.

The anastomosis between the stomach and jejunum was widely separated leaving a large opening in the jejunum at the duodenojejunal junction. The terminal portion of the duodenum was maintained for an inch and an end to end anastomosis was made between the duodenum and jejunum. The transverse colon was freed from the stomach leaving a large defect in the large intestine. The area bearing the defect was excised and repaired by an end to end anastomosis. The opening in the transverse mesocolon was closed by interrupted catgut sutures. About two thirds of the pyloric end of the stomach, including the ulcer area, was next resected. The proximal end of the duodenum closed by three layers of sutures and long loop of jejunum was brought up anteriorly over the colon. A portion of jejunum about 8 inches from the duodenojejunal junction was sutured to the distal end of the stomach anterior to the colon so that the end of the stomach was sutured to the side of this loop of jejunum. The abdomen was closed without drainage.

The patient recovered rapidly and began to gain in weight and strength. Considerable care had to be exercised throughout postoperative treatment, but the patient ultimately became free from all symptoms.

Both of these cases illustrate several principles of importance in connection with gastrojejunocolic fistula. The first case shows the difficulty of sometimes recognizing the condition in the early stages, the necessity for thorough radical treatment, and the gratifying results and comparatively short postoperative course in cases treated radically in the early stage. The second case justifies the suspicion of a fistula in the presence of persistent diarrhea following operation for gastric or duodenal ulcer. It shows the value of X-ray examination and the longer and more difficult postoperative course following treatment in the later stages. Both cases show the results which may be obtained by radical surgical treatment of such conditions, and

prove correct the opinions of others, especially of P. Clairmont and P. Hadjipetros (6) Zweig (23) and Bolton (4) and Mayo (19).

### RÉSUMÉ

1. Gastrocolic and gastrojejunocolic fistula have increased in frequency because of the more common surgical treatment of gastric and duodenal ulcers.

2. The prefistulous stage is the gastrojejunal ulcer after operation.

3. Any or all of the manifestations of fistula may be absent but persistent dyspepsia and diarrhea after operation should lead us to suspect a gastrocolic or gastrojejunocolic fistula. X-ray in several positions repeated several times, as well as the various methods of introducing colored substances per rectum and recovering them on washing out the stomach may establish the diagnosis in doubtful cases.

4. The four cardinal symptoms of a well developed case of fistula are fecal vomiting, fatty stools, diarrhea, and the X-ray findings.

5. Radical surgical treatment is the only method of curing the condition and the earlier it is undertaken the easier will be the operation and the shorter the postoperative course.

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## EMPHYSEMATOUS GANGRENE WITH REPORT OF CASES

BY W. F. GUNNILL, M.D. YORK, PENNSYLVANIA

From the Gynecological and Surgical Service of the New Hospital, Baltimore, Maryland

THE cause of emphysematous gangrene has long been known to be due to infection with the *bacillus aerogenes capsulatus* a name entirely appropriate because it describes the peculiarities and activities of the organism.

It appears that there is considerable confusion in regard to the action and clinical symptoms produced by this organism and by the *bacillus of malignant edema* or the so-called *vibrio septicus*. Even Keen's system of surgery though exceedingly clear and concise throughout on practically every subject is exceedingly hazy on the differentiation of the clinical phenomena produced by these two organisms.

In many respects the two infections resemble each other particularly in regard to crepitation and to the peculiar yellowish condition of the skin. In malignant edema the clinical manifestations begin several days later than we would expect from a gas bacillus infection and the infection seems to be more superficial. A fairly well defined line of demarcation may be seen with yellowish lines running upward following the course of the lymphatics. Indeed in this respect the infection except for the yellowish color resembles a superficial streptococcus skin infection. The subcutaneous tissues particularly the fat has a distinctive yellowish color resembling that of chicken fat.

The disease affects the subcutaneous tissues only the muscles escaping. The condition cannot be cured by amputation or by laying the tissues wide open by multiple incisions. The mortality is practically 100 per cent.

In contradistinction to the type of infection just described we find that clinical symptoms make their appearance much more quickly in gas bacillus infections. Crepitation is often the first symptom noted although quite recently Ritsman has called attention to the fact that air space can be demonstrated in the muscles and along the muscle planes by means

of the X ray long before crepitation can be elicited. The skin does not show to the same degree the deep yellowish tinge particularly at first and the chicken fat discoloration of the subcutaneous tissues does not obtain. The chief point of attack is the glycogen of the muscles, and the disease is often confined to a single muscle or group of muscles. Many cures are brought about by guillotine amputations, by removing whole muscles or groups of muscles or laying wide open, by long incisions, the skin and deeper tissues exposing the affected muscles to light and air under which conditions the organisms die because of their anaerobic proclivities.

Infection of the uterus with the *bacillus aerogenes capsulatus* is rather infrequent. Kelly and Noble speak of emphysematous conditions of the vagina but lay no particular stress on it and give the impression that though gas bacillus infections may take place other organisms or causes predominate as etiological factors. Few authors of textbooks on gynecology even mention the condition.

Christopher states that a careful search of recent medical literature revealed only seven writers, who report nine cases of gas gangrene in clinical practice. Because of the scarcity of the literature on the subject the following cases are reported.

**CASE.** Mrs. M. C., colored, age 38, eight approximately 30 pounds, entered the hospital at 3 p.m. October 7, 1921, in serious condition following an attempted abortion. She gave history of having inserted syringe nozzle at the cervix 3 days before October 4. On October 5, the patient had severe pain in the lower abdomen and passed quite a large number of clots per vagina. On arriving at the hospital the pulse at the wrist was scarcely perceptible.

Examination of the patient on removal to the ward showed a young mulatto woman comatose but practically pulseless at the wrist. Carotid pulse registered 140 per minute and poor volume. Temperature 98.6 degrees. The bowels covered with cold sweat. Heart showed no organic changes. The right arm had red lines over the triceps muscles and crepitation could be elicited from the elbow to

the shoulder girdle, and to a less extent on the dorsal surface of the forearm. The patient complained of pain in the above described areas.

The abdomen was not particularly tense but as somewhat tympanic. Vaginal examination revealed dilated cervix, admitting one finger. Some necrotic material with bad odor was obtained. The body of the uterus was not well defined on account of the tympanitic abdomen.

The laboratory reported the following: red blood cells, 4,864,000; white blood cells, 400; polymorphonuclears, 63 per cent; large, 11 per cent; small, 26 per cent; eosinophiles, 1 per cent; basophils, 0 per cent; blood pressure, 10-85; blood culture, negative at the end of 4 hours.

Urine: Catheterized specimen showed specific gravity 1.035; reaction alkaline; sugar negative; albumin 4 plus. Microscopic examination showed many granular casts, but no other abnormalities.

The patient was treated with intravenous stimulants, etc., and the carotid pulse, which on admission was 140 per minute, dropped to 120 per minute and improved in quality. The radial pulse could easily be counted. The general improvement of the patient was quite noticeable; she talked intelligently and seemed fairly comfortable.

Five hours after admission she suddenly expired almost before the nurse could reach her bed. The consensus of opinion was that the immediate cause of death was air embolism.

Examination after death revealed emphysema most marked in the right arm from the elbow to the shoulder, also very marked crepitations in the left thigh. (Patient had complained of severe pain in this area at 6 p.m. but no crepitations were noted at that time.) Crepitation was also noted in the right thigh, over the chest to below the nipple line, over the entire back, and in the left arm above the elbow.

The abdomen was remarkably free of evidences of the infection. The diagnosis was miscarriage and gas bacillus infection followed by gas embolism.

An autopsy was performed October 8, 1914, at 3 p.m. by Dr. Malde of Baltimore who gave the following report:

Colored female; light brown skin; height 5 feet 5 inches; weight 200 pounds.

Body is that of a very fat colored female. The entire body is swollen; skin is peeling and large blebs are present over entire body. The body crackles due to gas. Postmortem rigidity is partially present in the lower extremities. Skull normal; brain soft; breasts enlarged and contain colostrum; heart, soft and flabby showing septic changes; right side is dilated; valves and endocardium as well as the aorta are blood-tinged; lungs, voluminous, gas-ecce, oedematous, and congested; liver permeated with gas, soft, and honey-combed; spleen, enlarged and soft; kidneys, enlarged, soft, and congested; suprarenals, enlarged, soft, and congested; bladder empty; mucous membrane markedly congested; stomach, small and large intestines, distended with

gas; all are dull and glazed in appearance; ovaries, soft, enlarged, and inflamed; tubes are soft, enlarged and inflamed; uterus 5 by 4.5 inches, soft and inflamed; uterine cavity mucous membrane, and muscle soft and gangrenous; appearance an ill amount of blood present; part of placenta present; vagina dilated and gangrenous.

The cause of death was general sepsis due to gas gangrene of the uterus.

CASE 1. R. R. age 4, female white. Admitted August 9, 1912; died August 3. Patient was brought in the accident department, having been thrown from a truck. The left clavicle was fractured; there was laceration of the skin of the right leg and puncture wound of the left leg, and other bruises and abrasions. The wound was cleaned with boracic acid followed with iodine and the incision was closed. 140 stitches of silk dry sterile dressings were applied and 500 units of antitoxin were given. General anesthetic was used.

CASE 2. Eight days following admission the skin of the right leg had sloughed off leaving a large ulcer. Three days later the leg became swollen, extremely painful with a raised yellow infiltration along the outer aspect of the leg with chicken fat discoloration of the subcutaneous tissues. The condition at this time resembled gas gangrene.

The temperature varied from 98.6 to 99.4; pulse 78 to 100; respiration, 24; urine was negative. No other laboratory work was done. Hot sterile dressings were applied and sedatives were given. Patient died 12 days after admission.

Diagnosis: Fractured left clavicle; deep laceration of right leg; slight laceration on calf of left leg; Malignant oedema.

CASE 3. R. J. age 38, male colored. Admitted September 7, 1914; died, September 12. Ten days before admission the left foot became numb, painful, and diabetic gangrene of the toes set in which extended to the leg. The leg was amputated one week later. Six days later the stump became emphysematous and gangrenous. The patient went into coma and died 12 days later.

Laboratory examination: Urine: specific gravity 1.020; acid sugar 2 plus; albumin, 1 plus; positive bile.

CASE 4. Temperature varied from 100 to 104 degrees for 7 days, dropping to 99 and 100.

Patient died 7 weeks after admission.

Diagnosis: Diabetes; emphysematous gangrene.

CASE 5. R. H. age 4, white male. Admitted August 4, 1914.

The patient was admitted to the accident department in semiconscious condition having been thrown from a race car at Bay Shore Park. A deep laceration of the outer lateral aspect of the right thigh extended from below the crest of the ileum to the middle third of the thigh. The muscles were torn in shreds and the bone exposed. 500 units of antitoxin were given. The wound was cleaned, a debridement was done and the patient treated for shock. X-ray examinations revealed a

fracture of the fifth lumbar vertebra, fracture of the ascending ramus of ischium and a central fracture of the acetabulum. Air spaces were noted in the vicinity of the wound. The patient had retention of urine and suffered severe girdle pains.

Three days later the patient was removed to the operating room, as crepitations had been discovered in the region of the wound. Multiple long incisions were made and sections of diseased muscles removed. Drains were inserted and the wound dakinized.

Laboratory examination: Urine normal. Blood red blood cells, 3,200,000; haemoglobin 70 per cent; white blood cells 1,000; cultures were not made.

Patient made a slow recovery but on account of the fracture of the pelvis was kept in the hospital for several months.

Diagnosis: Fracture of pelvis. Laceration. Gas bacillus infection.

CASE 5. C. T. age 1, white male. Admitted November 16, 1921; discharged, February 3, 1923. Patient was admitted to the accident department with large gunshot wound in middle third of right arm and with destruction of muscles and nerves on extensor surface. He required 1,500 units of tetanus antitoxin. His family and personal histories were essentially negative.

The physical examination was negative except that the right upper extremity revealed an open gunshot wound on extensor surface of forearm. The extensor muscles were lacerated and the ulnar nerve shattered.

Course: The arm was amputated the day following admission and the wound was left open on account of suspicion of gas bacillus infection. Three days later the arm became swollen, edematous and sharply outlined. The arm was again opened and dakinized. The condition improved under dakinization. The culture for gas bacillus made January 18, 1923, was positive. The patient, discharged February 3, 1923, with the wound in good condition, and he was returned later for repair of the stump.

Laboratory examination: Urine specific gravity 1.018; otherwise negative. Blood on admission red blood cells, 2,300,000; haemoglobin, 5 per cent; N. white count was made.

The temperature came from 90 to 101 degrees 4 days following admission, and varied from normal to 101 for 4 weeks.

Diagnosis: Gunshot wound of right arm with gas bacillus infection.

It would seem that there are many more of these cases than the literature would indicate. During the summer of 1922 all of the above cases reported occurred within a period of 5 months at Bay View Hospital, Baltimore, Maryland, and many other cases must have been treated at the various other institutions in the city.

Neither the Prudential nor the Metropolitan Life Insurance Companies have any statistical data with reference to gas gangrene. They state: "As a cause of death it is not of sufficient numerical importance to justify statistical segregation of the few deaths reported." Perhaps the action of the various insurance companies can be explained by the statement of Dr. William H. Davis, chief statistician for vital statistics, Washington, D. C., who declares that "no data is available as to deaths from gas gangrene." According to the revised International list of causes of death all such deaths would be included under the term septicæmia.

The colored man, Case 3, developed gas gangrene following an amputation of the thigh for diabetic gangrene. This patient had been taken to and from the operating room on the same carriage that a few days before had conveyed a white man suffering with a gas infection. The beds of these two patients were on different floors of the hospital with different attendants and nurses.

Berkow and Tolk of New York report a similar case of infection developing in a patient whose bed was close to another bed in which a patient had died of the disease 3 days before. These authors attribute the infection to the spores which resist the ordinary hospital disinfection, and further conclude that although the gas bacillus was demonstrated in the muscle tissue of the local focus, yet the organism could not be found in the spleen, kidney, liver, brain, etc., even though extensive acute changes had taken place.

Attention is called to at least two facts recorded in Case 3: the great increase in weight after death (Welch 2) and the negative blood culture during life (Nullally and McNett, 3).

Because of the possibility of communicating the infection by fomites, unusual care must be taken in handling these cases and because of the mortality (Hartley 1) any treatment that offers any hope of cure should be instituted. While treating this series of cases an appeal was made to Dr. Bull (4) of the Rockefeller Institute to supply the hospital with tetanus perfringens antitoxin to combat the dread infection.

## SUMMARY

1 Attention is called to the differential diagnosis and prognosis of bacillus aerogenes capsulatus and bacillus oedematis maligni infections. Recovery occurred in 50 per cent of the cases suffering from infection with the bacillus welchii.

2 Early diagnosis of the condition is made by means of the X ray which shows air spaces in the diseased tissues even before crepitation exists.

3 There is a possibility of communicating the disease by fomites, as the spores seemingly resist the ordinary hospital sterilization of infected articles.

4 The disease is prevalent though heretofore considered rare in civilian life. This misconception is due either to improper diagnosis or to the classification of cases as septicemia.

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## FRACTURES OF THE ELBOW

AS TREATED IN THE OUT PATIENT DEPARTMENT OF THE ROOSEVELT HOSPITAL

B. CONDUCT W. CUTLER, M.D. AND HENRY W. CAVE, M.D. NEW YORK

**F**RACTURES of the elbow as considered in the analysis of the cases here presented are of the lower end of the humerus, and do not include fractures of the upper end of the radius and ulna. Our analysis is based on the study of 64 completed consecutively treated cases. No selection of cases was made.

The majority of these fractures occur in children or young adolescents at a time of life when the reparative processes are most active. In consequence the eventual result is good as regards union and restoration of function. When injuries of this type occur in adults, as in four cases of our series, the return of function is slower and less likely to be perfect while deformity is more commonly seen.

## MECHANISM

The injuries producing these interesting fractures may be briefly summarized as follows:

1 *A fall on the outstretched hand.* In this instance the force is most commonly transmitted through the radius and caputellum to the external condyle causing a fracture there.

A fall on the hand may also occasionally cause a transverse fracture of the humerus by sudden hyperextension the elbow joint being held rigid by the anterior and lateral ligaments. If these ligaments are torn by the sudden hyperextension a dislocation occurs instead of a fracture.

2 *Falls on the forearm.* When the forearm is flexed at right angles, the force of the blow received on the ulna forces it against the trochlea and fracture of the internal condyle results. When the forearm is flexed beyond a right angle the force of the fall transmitted through the ulna, tends to displace the condyles backward. This produces an epiphyseal separation, or the typical supracondylar transverse fracture.

3 *Falls on the elbow.* The inner condyle may be fractured by direct violence when a fall occurs and the arm is abducted. Similarly the external condyle may be chipped off by a fall with the arm against the body. A fall or blow on the olecranon when the elbow is flexed may produce the rare supracondylar fracture described by Posadas, in which the lower fragment is displaced forward.

4 *Forced adduction of the forearm* This may produce a fracture of the external condyle, or more commonly of the epicondyle by transmission of the force through the external lateral ligament

5 *Forced abduction of the forearm* In this injury the pull of the internal lateral ligament may fracture the internal condyle or epitrochlea. Occasionally a supracondyle fracture or epiphyseal separation is produced by forced abduction or adduction. When this occurs the condylar fragment is likely to be twisted somewhat in its backward displacement.

Although it has been difficult often to elicit satisfactory histories from our patients as to the exact manner of injury it will be seen that the various types of fracture observed in our series follow in a general way the mechanisms above described.

#### DIAGNOSIS

Diagnosis of the exact type of fracture occurring at the elbow is often very difficult because of the marked swelling which appears rapidly after the injury. In supracondylar fractures the lower end of the upper fragment may sometimes be felt projecting forward, if the displacement is great. In epiphyseal separations and in dicondylar fractures this protrusion is less marked. When the internal or external condyle is fractured the local cardinal signs are more readily elicited because of the relatively superficial position of the parts. The X-ray of course confirms the correctness of a diagnosis.

#### TREATMENT

Ashurst's comprehensive monograph on fractures of the elbow published in 1910 has done much to popularize the treatment of these injuries by the flexion method. We believe as the result of observation as well as from the evidence of published reports that the best results are to be obtained by following a program of accurate reduction, support on hyperflexion and early mobilization.

Reduction of the fragments to their normal position should be secured. If subsequent deformity is to be avoided. This reduction in

supracondylar fractures especially is also necessary to relieve pressure on nerves and blood vessels. It should be performed at the earliest possible moment.

Our method of reduction does not differ from that usually carried out. When the displacement of the lower fragment is backward the forearm is grasped and moderate hyperextension is made the object being to free the fragments. Countertraction is made by pulling backward on the upper arm, while at the same time firm pressure is exerted on the lower fragment to push it forward into position. This being done the arm is extended and the forearm abducted to make sure that no loss of carrying angle persists and that the reduction is satisfactory. The forearm is then brought into hyperflexion, abduction being maintained throughout the manipulation.

Every effort was made in practically all cases of our series, to produce and maintain hyperflexion after reduction. The advantages of this position, we feel, are as follows:

1 By this position the tendency of the forearm when extended to press backward the distal fragment is done away with.

2 The tendinous expansion of the triceps is put on tension and acts as a firm splint or sling in holding the reduced fragments in place.

3 In fractures above the condyles the periosteum is stripped up above the line of fracture. If not restored to its normal position by hyperflexion, this may lead to callus formation which will subsequently embarrass function.

4 A certain amount of stiffness is bound to follow these fractures, because of injury to soft parts and extravasation of blood and effusion in the joint. If at the start, flexion is assured, the more useful functions of the arm are maintained. Subsequent mobilization in the range of extension is more easy and is aided by the rational forces of gravity and the relatively strong pull of the triceps.

When the fracture is through the condyles, manipulation and flexion of the forearm and immobilization is in many cases all that is necessary. However not infrequently it is necessary to resort to nails driven through the condyle to be sure of a good reduction. Many

cases of internal condylar fracture come to open reduction, especially when the internal condyle has slipped into the joint. In our series no case of fracture of the internal condyle was treated by operation, but all were treated by hyperflexion.

Epiphyseal separations are at present coming more to immediate operation. Small incisions are made on either side of the elbow and bone hooks are inserted on either side of the fragment which is pulled forward into position. We believe that these separations if seen early will in the majority of cases, respond satisfactorily to careful manipulation and immobilization in hyperflexion. A slight deformity and moderate loss of function is often better than a complete ankylosis such as occasionally follows infection of the joint brought about by open operation.

The method of treatment by flexion employed in humerus injuries here reported was used as follows. The injured arm was placed in a position of flexion at the elbow as complete as the swelling would permit and in full supination. It was retained in this position by two adhesive straps passing from the upper humeral region to the wrist one on the outer and one on the inner side of the arm. This dressing was re-enforced and the arm supported by a figure-of-eight bandage passing over the shoulder on the injured side about the elbow and under the opposite axilla.

This dressing was usually inspected after 24 hours and the flexion increased if possible. Increase of the amount of flexion was made at 24 or 48 hour intervals thereafter until the flexion was complete that is until the fingers could be made to touch the acromion on the injured side. This result was attained on the average about the fourteenth day.

Passive motion was then usually begun the arm being carried in a sling, and the patient directed to flex the arm completely a number of times a day to preserve the motion gained. Baking, massage and passive motion by the masseuse were customarily begun at this time and efforts to gain a greater range of extension were instituted. The arm was allowed to hang out of the sling for an increasing length of time each day and by

the third week the patients were instructed to carry weights to increase extension by gravity. If at any time during this procedure the ability to completely flex the arm was lost (as it was in a few instances where satisfactory co-operation of the patients was not obtained) the arm was returned to the flexion dressing and the process repeated.

By this method it was possible to attain a fairly wide range of motion by the time that firm union had occurred and the more useful motions of the arm in the range of flexion were secured early.

#### SUPRACONDYLAR FRACTURES

Supracondylar fractures were the most common injuries in this series of 64 complete cases. There were in all 38 of these fractures. Nine occurred in the right arm and 19 in the left while four were not recorded. These injuries all occurred in children the average age of the patients being 8 years. The oldest was 15 and the youngest 3.

The nature of the injury was given as "fall on the elbow" in 14 cases, "fall on the outstretched hand" in 6 cases, "fall on the bent arm" in 1 case, while in the remaining 11 the mechanism was not known.

Displacement of the fragment sufficient to require reduction under a general anesthesia was present in 9 cases, while one case required two attempts to attain a satisfactory position. In 5 of the cases reduced the displacement of the distal fragment was reported as backward while 1 case presented a distinct comminution as well. Twenty four cases were immobilized in acute flexion, 1 (the comminuted case) in acute flexion in plaster, 4 with right angle splints, 1 with a split plaster dressing followed by flexion on the ninth day and 3 by means of extension.

The average duration of passive motion baking, and massage in these cases of supracondylar fracture was 30.5 days, while the average duration of treatment was 50.5 days. Twenty cases of this group of supracondylar injuries were discharged with good union and full function while 12 were not cured at the time of stopping treatment. Of these latter 8 subsequently reported with perfect results, while 4 were not cured when seen at

the follow up. Of the 4 cases not cured 2 had a diminution of the normal carrying angle but with complete restoration of flexion and extension 1 (the case mentioned as having a bad comminution) had no deformity but showed a limitation in motion 5 degrees short of full extension Flexion was complete In the fourth case at the time of reduction, a plaster-of Paris right angle splint was used by the family doctor The carrying angle was perfect, but the patient lacked full extension by 10 degrees Flexion however was complete

#### INTERNAL CONDYLE FRACTURES

Four internal condyle fractures were recorded One occurred in the oldest patient in the series, a woman of 60 As nearly as could be ascertained she had fallen with the arm adducted and extended beneath the body Deformity (gun-stock) was present and abnormal mobility and crepitus A ray examination revealed the internal condyle displaced forward Reduction under anesthesia was done, followed by immobilization in flexion Motion was begun on the seventeenth day and continued for 83 days with massage and baking The patient was discharged on the one-hundredth day with good union, no deformity but with range of motion limited (mid flexion to mid extension) On recall, 15 months later flexion was complete extension beyond 130 degrees and the arm was reported stronger and useful

Of the other 3 1 was caused by direct blow the other 2 by indirect violence All were treated by acute flexion The average number of days before the beginning of motion was 11.8 and the average number of days under treatment was 38.3 A cure resulted in all cases

#### EXTERNAL CONDYLE FRACTURES

There were 7 cases of external condyle fractures, 2 right and 5 left All resulted from "falls on the elbow Displacement in 1 case was reduced under anesthesia These cases were put up in hyperflexion In all of the cases of this group the patients were discharged from the hospital with full restoration of function.

#### EPISTROCHLEAR FRACTURES

Epistochlear fractures were 7 in number 3 on the right side 2 left, and 2 not recorded Four resulted from "falls on the elbow one from fall on the arm, and one from catching and twisting the arm in the bandsters, while one was associated with a backward dislocation of both bones of the fore arm The average age of the patients was 11.2 years.

All 7 cases were treated by the flexion method No reductions were needed Motion was begun on the average on the sixteenth day average duration, 21 days The cases averaged 38 days of treatment Four patients were cured before being discharged, while 3 presented limitation of extension at the time treatment was abandoned These 3 patients subsequently reported complete return of function on recall

#### CAPITELLUM FRACTURES

Fractures of the capitellum were 4 in number 3 being in the right arm one in the left One injury resulted from a fall on the extended hand, one from twist of the arm, and the other two from a fall on the elbow The patients ages were 9, 12, 11 and 3 years.

Treatment was by acute flexion in each case there being no reduction required The average duration of treatment was 19 days Three patients were discharged cured, while one abandoned treatment at the end of 24 days, at which time full flexion to right angle flexion was the range of active motion

This patient a boy of 12 had suffered an injury of the elbow 4 years before the fracture for which he was under care Since that time he had had a diminished carrying angle When seen 8 months after leaving our care, the loss of carrying angle was still present, but the range of motion had increased at the elbow joint His final result was recorded as "full flexion, practically complete extension There was little disturbance of function

#### INTERCONDYLAR FRACTURES

This group included 2 cases of intercondylar fractures In 1 of these the injury was caused by a fall on the tip of the elbow while in the other the injury was sustained

by the arm being caught and twisted in a machine belt. One of these fractures was in the right arm, one in the left. The ages of the patients were 11 and 30 years.

Treatment in one case was by the acute flexion method. The adult case required reduction and the application of plaster followed by the acute flexion treatment. The average time to the beginning of passive motion was 8 days, baking and massage was 16 days, while the average duration of these procedures was 52 days. The average length of treatment was 70 days. The results obtained in this group were as follows: discharged cured, 1 abandoned treatment, not cured 1. The latter still had limitation of extension at the expiration of 5 years.

#### EXTERNAL EPICONDYLE FRACTURES

One case of epicondyle fracture was seen. This injury resulted from "a fall on the elbow." The patient was 8 years old. No reduction was necessary, the treatment being by the acute flexion method. Motion was begun on the eleventh day, the total duration

of treatment being 20 days. The patient was discharged with good union and complete function.

#### EPIPHYSEAL SEPARATIONS

Our group of epiphyseal separations consisted of 7 cases, 3 right and 4 left, all treated by hyperflexion following reduction. The average number of days before the beginning of motion was 18, and the average number of days of passive motion and massage was 23. The average number of days under treatment was 46.6. All cases secured excellent results.

#### RESULTS

Number of cases, 64. Cured, 76.5 per cent. Results at time of discharge: not cured 25 per cent, cured 68.7 per cent. Late results on cases not cured at time of discharge: not cured 31.2 per cent. Cases ultimately cured (complete flexion, complete extension, full supination and pronation) 89 per cent.

There were 5 cases without complete flexion or extension, incomplete pronation or supination or gunstock deformity.



## BACKACHE FROM VERTEBRAL ANOMALY

BY THEODORE A. WILLIS, M.D. F.A.C.S. CLEVELAND, OHIO

From the Anatomical Laboratory, Western Reserve University

IN the sixth group, the third of the numerous causes of backache as classified by Straub (1) is given as "congenital defects." Passing by the author's other sixty odd causes with the statement that there is considerable reduplication we will consider some of the more important of the anomalies of the lower portion of the spinal column. It should not be difficult to differentiate the backaches due to anomalies from those of reflex inflammatory and neoplastic origin. The lack of definite local symptoms of the reflex type, and the presence of such evidence in the inflammatory and neoplastic types should be sufficiently ready determination. As Straub points out, however, we must not be too willing to ascribe clinical symptoms to the presence of a congenital anomaly simply because it exists. These symptoms may be the result of a coexistent condition. Also we know that defects often exist without producing clinical signs. Their chief importance is derived from their tendency to weaken the mechanical construction of the part thus predisposing to injury and delaying or even preventing recovery after injury has occurred.

Though the human vertebral column has attained a stability of form far greater than that of other primates (2) it still presents a more or less distinct variability of structure particularly of the thoracolumbar portion—11.6 per cent in 850 subjects—(3). As shown by Todd (2) in the essay just referred to the numerical variation of the presacral vertebral segments is the result of a phylogenetic shortening of the spinal column which is accomplished by the progression of the pelvic girdle upward upon the spine. Todd follows this process from the primitive mammalian forms to the giant apes, tabulating the degree of variability in the various genera as they branch off from the parent stem. As a result of this evolutionary process the human vertebral column presents a numerical variability in its thoracolumbar segments of from 18 to 16 the modal number of course being 17 (3).

In addition to this numerical variability we find that as the progress of the ilia upon the column is accomplished by an encroachment of these bones upon the lumbar segments, there are many degrees of partial sacralization of the last lumbar segment and a freeing of the first sacral. This then being the most unstable region of the column, is the most subject to developmental defects and anomalies.

The study of some 850 spinal columns in the Hamann Museum has convinced the writer that the congenital anomalies of clinical importance in low back pains may be divided into two general groups either of which may weaken to a marked degree the mechanical stability of the column. The first and most important group includes defects of the last presacral vertebra. The second includes anomalies of the articular processes between the last lumbar and the first sacral segments. Defects of the first group have been described as split and separate neural arches (4). They are variants of one type of anomaly and consist of one or more interruptions in the continuity of the arch. In addition, this group includes variations in the size and form of the transverse processes of the last lumbar segment and its occasional impingement upon, or articulation with the ilia.

The split spinous process is very generally recognized as the ordinary spina bifida in its various degrees of development. The fact that the interruption in continuity may and more often does, occur in the lateral portions of the arch is not so generally appreciated. That the defect is often bilateral and at times is even triple is even less commonly known. From the least degree of this defect consisting of an undeveloped or split spinous process to the extreme degree in which the neural arch is represented by two separate and diminutive lateral halves the subjects examined show many intergradations of the defect.

The centrally split arch (Fig. 1) was found in 1.2 per cent of the spines examined. The bilateral separation occurring between the

superior and inferior articular processes of the vertebra (Fig 2) existed in 4.8 per cent. In 0.6 per cent the central and lateral defects were combined in the same arch (Figs 3 and 4). In 8 cases there was unilateral separation of the arch and strangely enough this occurred always upon the right side (Fig 5).

Poirier, Cunningham, and other anatomists have mentioned these defects as skeletal variations. Le Double discussed the condition in 1912 and quoted 33 cases on record at that time. In a recent paper (4) we reported 31 cases from the Hamann Museum and can now add 4 more to the number. Neugebauer (5) and Poirier (6) refer to these lateral separations in discussing spondylolisthesis. The former ascribes the break in continuity to lack of fusion between two centers of ossification from which he maintains that each lateral half arch is formed. The latter while recognizing such centers of ossification thinks that the break is due to mechanical strain consequent upon the upright posture. Lane (7) considered it the result of a gradual excavation of the laminae by the adjacent articular processes. As we have shown in the previous paper the separation occurs at such diverse points that the assumption—and we are unable to find evidence that it is more than an assumption—of the existence of two such centers of ossification does not aid materially in explaining the situation. This can be more satisfactorily accomplished by the recognition of more or less frequently occurring developmental irregularities in ossification with resulting synchondroses. These may occur at any point or points in the arch of the unstable vertebra and with the final arrest of development, remain as irregular interruptions of bony continuity. Such fibrocartilaginous areas are more prone to forcible separation under strain than is bone substance and once separated show little if any tendency to reunite.

As stated above, the columns, in addition to numerical variation, showed different stages of the process. According to Dwight (8) when a numerical variation does occur the newly related segment assumes the function of the one displaced. We therefore find instances in which though the sacralization is incomplete the transverse processes of the last lumbar are



Fig. Central defect in neural arch of last (11 only fourth) presacral vertebra. Male, late, age ca 4 years (W. R. U. 50).

assuming the relation to one or both ilia usually held by the first sacral segment. As would be expected this was found most frequently in those columns presenting an increased number of presacral segments. Though many of the transverse processes were large and extended beyond the posterior limit of the ilia so that in flat X rays they would appear to impinge upon these bones, in only five cases was there actual evidence of such bone contact. This occurred in 0.41 per cent of the modal columns and in 7.7 per cent of those presenting an extra thoracolumbar segment.

Rugh (9) stresses the frequent overlapping of these processes without actual contact and urges the necessity of either stereoscopic X rays or flat views from several angles in order to determine the condition roentgenographically.

Anomalies of the second group, namely of the articular processes between the last lumbar segment and the sacrum have been mentioned by various writers. Variations from the usual articular arrangement have recently been described and illustrated by Goldthwait (10). Others have supported his views. Such variations consist particularly



Fig. 2



Fig. 3



Fig. 4

Fig. 2. Bilateral laminar defect occurring between the superior and inferior articular processes of the last (1 only fourth) presacral vertebra. Female, white, age 64 years (W. R. U. 14).

Fig. 3. Central and right laminar defect of last (1 only

fourth) presacral vertebra. Male, white, age 30 years (W. R. U. 3).

Fig. 4. Central and bilateral laminar defects of last (1 only fifth) presacral vertebra. Male, white, age 35 years (W. R. U. 50).

in the degree of development and angle of projection of the inferior articular processes of the last lumbar and the superior processes of the sacrum. It is the apposition of the latter to the former that normally prevents the lumbar spine from coming downward and forward over the oblique superior surface of the sacrum. When the bony anchorage is lost the stability of the spine is dependent upon its ligamentous structure, notably the ilio-lumbar, the sacro-spiral, the inter and supraspinous ligaments, a powerful group to be sure but often not strong enough to withstand the enormous twisting leverage to which this part of the spine is subjected.

The frequency with which defect of both of these groups were found among the subjects examined in this series, and the frequency with which they were demonstrated among those subjects requiring relief from back symptoms signifies a close relation between the existence of the defects and the clinical evidence of disability. The fact that the defects are frequently demonstrated when no symptoms exist and that the symptoms usually follow more or less severe trauma would indicate that the defects are predisposing rather than direct in etiology. The milder grades of split spinous processes can affect the stability of the column only by weakening the attachment of the inter and supraspinous ligaments. These are the ligaments which bind the adjacent spinous processes together

limiting forward and to some degree lateral mobility of the spine. Injury to these ligaments occurs after forcible flexion of the spine and results in pain on further flexion and on direct pressure upon the injured area. That this defect does predispose to injury is shown by the fact that in a series of 100 roentgenograms taken for the diagnosis of low back pain it was present in 10 per cent while of the 850 anatomical specimens examined it was found in only 1.2 per cent.

When the defect destroys the integrity of that portion of the bony arch between the vertebral body and the inferior articular processes and in the case of a bilaterally separate neural arch the condition is much more serious. Here we have the anchorage of the spine depending merely upon a fibrocartilaginous union with ligamentous and muscular support. When this union is once ruptured stability is permanently lost.

This then is the explanation of the ordinary case of spondylolisthesis, a condition by no means as infrequent as generally supposed. It cannot possibly occur so long as the inferior articular processes of the last lumbar vertebra retain their usual relation to the body of that vertebra and to the superior articular processes of the sacrum. The inferior processes may, as a result of an extremely severe injury be torn from their attachments and lifted over the superior processes or if anomalous in shape, they may be forced past the superior



Fig. 5

Fig. 5. Right lamina defect alone in last (twenty-fourth) presacral vertebra. Male, white, age 45 years (W R U 73).



Fig. 6

Fig. 6. Complete separation of neural arch in last (twenty-fourth) presacral vertebra. Spondylolisthesis with consequent beveling of the anterior portion of the superior



Fig. 7

surface of the sacrum. Female, white, age 38 years (W R U 42).

Fig. 7. Complete separation of neural arch in last (twenty-fourth) presacral vertebra. Spondylolisthesis with consequent beveling of upper aspect body of sacrum. Male, white, age 4 years (W R U 879).

sacral processes the entire vertebra being then displaced forward on the sacrum. In either case the injury must be of greater clinical severity than is found in the ordinary spondylolisthetic. The writer has recently had under his care a railroad employee who fell headlong from the window of his cab. The twelfth dorsal vertebra was dislocated forward on the first lumbar, the articular processes of the former being lifted over those of the latter without fracture of either. The patient was completely paralyzed below the point of injury. Such an effect is the only conceivable result of so severe an injury. Certainly no such thing has happened to the usual patient who enters the clinic complaining of weakness, discomfort, and pain in the lower back and thighs. In this latter type of case we must find an explanation which entails less strain upon the imagination. The forward displacement of the centrum must take place without the lifting of the hooks of the upper vertebra over a half inch obstacle to which they are securely attached by ligaments. It must be forced forward independently of its articular processes. Failing an anomaly of the articular processes themselves this can be accomplished only if there is an interruption in continuity of the laminae between the centrum and the articular processes. The interruption may be due either to failure

of such continuity to develop or to its dissolution later.

That thirty-four of the cases of separate arch occurred in males and only one in a female has suggested that the condition is really a fracture. This evidence is outweighed, however, by the following facts. After fracture of any bone there is either an attempt at repair or in rare instances there is no such attempt. In the first case formative bone should be found about the site of the injury. In the second case the rough broken ends of the bone are gradually smoothed over by absorption. No evidence of either process was found in the cases examined. The bone ends were irregularly serrated resembling more or less the synchondroses of the skull though not so thoroughly interlocked. In addition there was no demonstrable cumulative increased incidence of the condition with age.

The markedly greater incidence in males is not readily explained. As illustrated in the paper dealing with numerical variation in the human vertebral column (3) there is no really definite difference in this respect between the sexes in either white or negro stock. What evidence there is, however, is slightly in favor of greater stability in the female.

We would expect in a study based upon osteological material that if displacement of

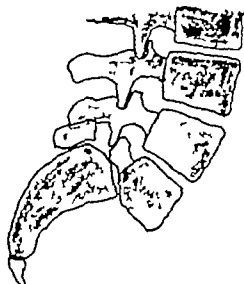


Fig. 6.

the lumbar upon the sacral element of the column occurred frequently or persisted for some time there should be evidence of the fact expressed by alteration in form of the involved bones due to stresses and strains consequent upon the changed mechanical relation of the parts. Such evidence is presented by skeleton No. 421 (Fig. 6) which is that of a white female 38 years of age, and No. 879 (Fig. 7) that of a white male 45 years of age. Both of these subjects show a marked beveling of the anterior portion of the superior surface of the sacrum and a distinct rounding forward of the articular processes. These curves correspond exactly to reverse curves on the under surface of the last lumbar segment and its articular processes. These specimens also present marked hypertrophic changes in relation to the lumbosacral regions but at no other portion of the spine. The hypertrophy may therefore be ascribed to local irritation of a chronic type probably due to mechanical strain.

Similar beveling of the adjacent surfaces of the centra of the last lumbar and first sacral elements was found in five of those specimens presenting bilateral separation of the neural arch but in none of the remaining eight hundred odd spines.



Fig. 8.

Fig. 8. Traces from osteograms of case of spondylolisthesis. I. Anteroposterior view showing split and bilaterally separated neural arch as illustrated in Figure 4. II. Lateral view showing forward displacement of the fifth lumbar vertebra on the sacrum.

Clinical symptom arising from this type of spondylolisthesis may be due to either or both of the following factors. First such a displacement implies separation of the lamina at the point of bone interruption with injury to the ligamentous structures those binding the arch to the body and those which maintain the relationship of the last lumbar segment to the sacrum and to the ilia. Second, the symptom may be due to pressure on the lower spinal nerves either those remaining in the canal or those passing anteriorly to the lumbosacral articulation. Ligamentous injury here is not different from that occurring elsewhere. Nerve irritation might involve the spinal root from the fourth lumbar down.

Separation of the arch at the point of synchondrosis requires considerable force. In the several examples found in cadavers before maceration slight mobility only could be elicited and in one case the condition was entirely overlooked because of the action of powerful uniting ligaments, even after the muscles and most of the vertebral ligaments had been removed. When the separation has once been accomplished however there is no tendency toward repair the disability remaining as is evidenced by chronic ligamentous and nerve irritation.

Articulation of the transverse processes of the last lumbar vertebra with the ilia or their

impingement upon the ilia has been considered by many writers as the cause of clinical symptoms. In many cases removal of impinging processes has been followed by relief of symptoms. In many cases the symptoms have been relieved without the removal of the processes. This subject has been discussed recently by Moore (11) who attributes the symptoms either to strain of the sacro-sciatic and sacrolumbar ligaments due to leverage of the process against the ilium or to stretching of the neighboring nerves or to both. He has discarded the theories of pressure on other soft parts and of irritation of a bursa interposed between the process and ilium. His conclusion is that patients recover both with and without operation and that the matter is still open for discussion.

Many regard one type of ligamentous strain as due to abnormal leverage of the process against the ilium. Release of this leverage by removal of the outer portion of the process or the impinged portion of the ilium would correct the condition should it be demonstrated that such a condition actually exists. Removal of a portion of ilium as Moore suggests, is a much simpler operation. When only the outer portion of the process was removed the operation was as successful as when the entire process was removed. The former procedure would endanger the nerve to less extent. Results would seem to indicate that symptoms arose from leverage rather than from pressure on the nerves.

Incomplete fusion of the transverse processes with or their impingement upon the sacrum likewise exposes the parts to abnormal leverage and consequent ligamentous injury particularly when the condition is unilateral as are the majority of the partial sacralizations. Complete sacralization of the last lumbar can have no effect other than shortening of the mobile portion of the spine. We doubt that clinical symptoms are due alone to sacralization of the last lumbar whichever numerical segment it may be.

The anomalies of the articular processes of the lumbosacral juncture mentioned by Goldthwait (10) were observed in various grades of development among the specimens



Fig. 9. Roentgenogram showing complete separation of neural arch in last (fifth) lumbar vertebra. Note the deformation of the lamina laterally, the distinct hiatus between superior and inferior articular processes. Male, white, age 50 years (W. R. U. 939).

examined. They were more often unilateral than bilateral. They undoubtedly diminish the stability of the region. The bilateral type of flat or deflected process subjects the possessor to all sorts of strains, the unilateral type particularly to rotary strains.

Diagnosis of the various types of anomaly discussed is based ultimately upon the X-ray. However certain clinical features are very suggestive. These are essentially signs of ligamentous injury and are the same as such symptoms occurring elsewhere: pain aggravated by local pressure and by those distinct motions which produce tension on the traumatized area; spasm of the muscles which resist these movements; and limitation of motion. The parts are too deeply situated to give rise to perceptible local heat, redness, and swelling. In addition we have found in the bilaterally separate arch acute sensitiveness to pressure directly upon the spinous process. In old-standing cases this process may be moved from side to side by the examiner, the manipulation causing considerable pain.

In the centrally split arch the partially sacralized lumbar the impinging transverse process, and the atypical articular process, careful study of a stereoscopic X-ray may make the diagnosis clear. In the lateral laminar defect we find the X-ray not sufficiently definite. When the condition has progressed to a spondylolisthesis a lateral view is diagnostic but not before (Fig. 8).

In the cadavera we found it impossible to produce positive roentgenographic evidence of the condition actually known to exist. The lines of separation were so obscured in the general structure of the part that neither the lateral nor the anteroposterior stereoscopic view was satisfactory in all cases. A semi-lateral view suggested by Dr. Hill was more definite in the muscle free torso but in the living subject the bone area is too far removed from the film and the parts are distorted. All in all the anteroposterior stereoscopic view was found the most satisfactory for diagnosis. These show a delamination laterally of the laminae which we have come to regard as diagnostic of the condition (Fig. 9). This is not seen in the other laminae of the same field which clearly merge with their bodies.

Treatment of the symptoms due to these defects must be based upon the pathological features present. Traumatized ligaments require protection from further injury while their recovery is being hastened by active movement within the bounds of protection, careful massage, and local heat. Protection usually implies strapping braces, etc. Rupture of the synchondrosis is more serious than the ligamentous injury which accompanies it. The separated bone ends are covered with cartilaginous material and therefore, show no tendency to reunite. If the parts are restored to their normal position the torn ligaments may unite and recover an intimate relation subject to repetition of the trauma. The interruption of continuity remaining as a permanently weakened link constituting a contra indication to vocations entailing heavy lifting and active flexion of the back.

It is probable that in at least some of these cases a method of procuring bone anchorage

may be developed either by means of a graft along the transverse processes or by freshening the separated bone ends. As yet this has not been sufficiently proved. In case of the impinging transverse process the work of Brown, Goldthwait, and others must not be forgotten. They have shown that the exaggerated lumbar curve of the relaxed posture induced by tipping the pelvis forward approximates the iliac wings to the transverse processes. Operative procedure need be resorted to only after thorough relaxation in dorsal recumbency followed by postural training and support. In the great majority of cases it will not then be required.

#### SUMMARY

Though the human spinal column is the most stable of the primate columns, it still presents frequent variations from the modal type. These variations result from an evolutionary shortening of the column by cephalad progression of the pelvic girdle complex upon the column. The articulation of the girdle with the column is, therefore, a region of morphological instability as evidenced by the frequent occurrence of development anomalies. Spinal columns thus affected are pre-disposed to mechanical derangement the symptoms of which are essentially ligamentous in origin.

The anomalies may be divided into two groups one of which involves the last lumbar segment alone the other affects the articulation between this segment and the first sacral. The former includes various types of inter-ruption in continuity of the neural arch and the atypical transverse process. The defect of the arch is responsible for the occurrence of spondylolisthesis and kindred disorders. The latter group comprises the abnormal developmental formations of the articular processes. Each group gives rise to definite clinical syndromes. The form of treatment and prognosis depend upon the individual case.

The writer likes to acknowledge his indebtedness to Dr. Wagnon Todd for his guidance in the preparation of this paper as well as for his kindness in placing the material of the Harmon Museum and the photographic facilities of his department at our disposal.

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URETEROPYELOGRAPHY (UROGRAPHY) IN ABDOMINAL DIAGNOSIS<sup>1</sup>

B. DANIEL N. TISENDRATH, B. A. M. D. F. A. C. S. CHICAGO

THE importance of a thorough examination of the urinary tract in the differential diagnosis of many of the clinical pictures of abdominal lesions is not as fully appreciated as it deserves to be. This is especially true of the method known as ureteropyelography which consists in filling the lumen of the renal pelvis and ureter with a solution opaque to the X-ray. Although there were some reports of fatalities in the early history of the method these were due, as the experimental work of the author<sup>2</sup> and others have shown to the use of media which were either very toxic or were injected under such pressure as to cause death from embolism e. g. of the lungs. The employment of non-toxic solutions such as sodium bromide or iodide and above all the avoidance of much pressure in distention of the ureter and renal pelvis has resulted in such widespread use of the method that it has become an almost indispensable part of our examination of the urinary tract in all cases except those in which there is an accompanying acute infection.

It is almost as frequently applied today as ureteral catheterization and is, in the opinion of the majority of those engaged in this special field not any more apt to be followed by ill effects than is ureteral catheterization itself.

My reason for bringing this method of diagnosis before you is because it is seldom employed by either the internist, gynecologist, or general surgeon. A lack of knowledge of its valuable aid in the making of an abdominal diagnosis has resulted in the performance of many operations which were disappointing in their results both to the patient and the physician because of the recurrence of the original symptoms. I find that there is still much prejudice against the use of pyeloureterography because of (a) the early fatalities and (b) the opinion that it is technically very difficult. My only object in this paper is to attempt to point out some of the problems which the method will be of assistance in

solving and to urge its more or less routine use in many of the abdominal cases presenting either pain or enlargement as the outstanding features of the clinical picture.

The subject has attained such dimensions in the past 10 years that it would be folly less either to take it up in a technical manner or to describe all of the various changes due to disease. Hence I shall confine myself to a brief reference to some of the normal and pathological findings.

The interpretation of pyeloureterograms and the application of the method must remain the special field of the urologist. Since, however, nearly every well-organized hospital or clinic includes such a specialist on its staff there can no longer be any excuse for the omission of the method from the examination.

## NORMAL URETEROPYELOGRAMS AND KINDS OF THE URETER

One must in this field, as in so many others, be thoroughly familiar with the appearance of the roentgenograms taken in normal individuals lest some serious error in diagnosis be made.

The most frequent type of renal pelvis is that shown as *a* of Figure 1 where there is a well developed pelvis proper from which arise superior middle and inferior major calyces, and from these in turn a variable number of minor calyces arise. This is the ampullary pelvis which may show variations such as those shown in *b*, *c*, and *d* of Figure 1 where the pelvis proper (*b* of Fig. 1) is elongated and less triangular or where the pelvis is relatively small so that the major calyces seem to arise as they do in the embryo, almost directly from the ureter itself without the interposition of a renal pelvis. Finally one may see a pelvis such as *d* of Figure 1 where there is scarcely any narrowing of the pelvis at its junction with the ureter while the major calyces are so long necked that at first sight they seem to be elongated as if by pressure and traction, a picture quite often seen in



Fig. 1. Variations in normal pyelograms. Typical ampullary pelvis with small middle and well developed upper and lower major calyces. b long tapering pelvis with

well developed middle major calyces. c very small pelvis proper with well developed upper middle and lower major calyces. d tapering pelvis with long necked major calyces.

neoplasms of the kidney. I could show many more variations of the normal renal pelvis, but I shall refer only to two other types of pelvis: the bifid and trifid in which the ureter divides, usually extrarenally into two or three major calyces so that there is a complete absence of a renal pelvis.

Fortunately there are not as many variations in the appearance of the ureter when filled with a contrast fluid. The normal points of narrowing and widening of the lumen are so familiar that it seems almost superfluous to recall the fact that there are points of narrowing (a) just below the ureteropelvic junction, (b) where the ureter crosses the iliac vessels, and (c) just before it enters the bladder wall. Between these three there are two spindle-like wider areas: the pelvic and lumbar spindles respectively.

No matter how well we remember these from our dissecting room studies, one is apt at times to forget them when confronted by a ureterogram. Of greater importance to my mind in this connection are the questions (a) to what extent is the width of the shadow of a ureterogram dependent upon the amount of fluid injected, and (b) how commonly are kinks present in the normal ureter.

The study of these two questions is one which is as indispensable as thorough familiarity with variations in the normal renal

pelvis and ureter. I feel confident that mistakes have been made by many of us because we are not sufficiently familiar with variations in the normal individual. Drs. F. M. Phifer, Harry Culver, and Cora Matthews of our Cook County Staff (to whom I am greatly indebted for co-operation in ureteropyelography) and the writer are at present engaged in a study of the subject. We feel that the normal ureter is capable of giving a narrow or somewhat wider shadow according to the amount of fluid injected. Again we find so-called

kinks of the ureter as shown in Figure 2 so frequently where there have been absolutely no clinical symptoms that we question whether the ureter may not be so redundant as to fold upon itself even when the kidney is in a normal location and not abnormally mobile. It is very easy to create an artificial kink of the ureter with the catheter and this has taught us never to make a ureterogram unless the catheter has either been withdrawn entirely or is in the lowermost portion of the ureter.

I have dwelt at length upon this question of variations in the normal individual because I fear that ureteropyelography will be discredited if entire dependence is placed upon it in the making of a diagnosis. I have been shown and have recently seen illustrated "kinks" of the ureter which were considered



Fig. Well marked kinks of the normal ureter. There was complete absence of symptoms on the side corresponding to these ureterograms. Note the difference in character of pelvic and major calyces in these three ureterograms.

the cause of the clinical picture but did not differ from those obtained so frequently (Fig. 2) on the side where there is an absence of symptoms or objective findings. I shall refer later to the folly of depending upon the ureterogram alone in the diagnosis of stricture because there is much variation in the distensibility of the lumen of the normal ureter i. e. when the condition known as inflamm-

tory or obstructive dilatation (Figs. 7 and 8 respectively) is absent. Before leaving the subject of normal conditions let me impress you with the necessity of bearing in mind that anomalies in the form, size, number and location (Fig. 3) of the kidneys may be present when least suspected. The constantly increasing number of reports of cases in which horseshoe, ectopic (ordinary and crossed), solitary or double kidney have been recognized clinically by the use of ureteropyelography demonstrates the fact that it is necessary to consider these anomalies in our differential diagnosis of all abdominal lesions.

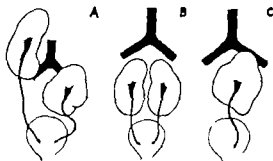


Fig. 3. A, Ictopus (congenital) of the kidney. B, Illustration of bilateral pelvic ectopic kidney. C, Illustration of unilateral (median) ectopic kidney.

#### PAIN AND TUMOR DIAGNOSIS AIDED BY PYELO-URETEROGRAPHY

It is in the interpretation of the cause of abdominal pain and of tumor that the method which I urge you to employ more frequently is of the greatest value.

Neither time nor space permit of a detailed description of the chief differential points between lesions involving the various ab-



Fig. 5 (left) Ureterogram in case of ureteral calculus. Location of latter is at lighter area (indicated by arrow) in pelvis portion of the ureter. Not dilated renal pelvis.

Fig. 6 Ureterogram in case of stricture of pelvis portion of right ureter. Principal symptom—pain in right lower quadrant. Note dilatation of ureter above stricture.

Fig. 4 Case of renal calculus previously operated upon for supposed gall bladder and appendix symptoms (F. asked for Dr. C. F. Kahlke). Shadow of calculus before ureterogram—as made. b. calculus shadow included in that of dilated ureter and renal pelvis.

dominal structures outside of the upper urinary tract and those of the latter. It would be equally superfluous to attempt to enumerate all of the valuable information which pyeloureterography yields in the various affections of the kidney and ureter; hence I shall refer only briefly to some of the more common of these as follows:

#### RENAL AND URETERAL CALCULI

If the renal calculus is of a branching or coral-like character a pyelogram is hardly necessary as a rule. It is in the differentiation of shadows due to calculi in the gall bladder, bile ducts or pancreas as well as of other extrarenal and ureteral shadows that pyelography is of especial value. If a suspicious shadow is covered by or included in the pyelogram (Fig. 4) the shadow is certainly due to a renal calculus. In some cases a lighter area corresponding to the calculus is seen.

As roentgenography progresses we are being taught that there is nothing characteristic of a renal calculus shadow which may not

be equally possessed by a gall stone, common duct or pancreatic stone, and further that the simultaneous existence of these and kidney stones must be constantly borne in mind. In the case shown in Figure 4 the patient had been operated upon elsewhere for gall bladder and appendiceal trouble. On account of recurrence of symptoms I was asked by Dr. C. E. Kahlke to examine the urinary tract. The "inclusion" of the shadow seen over the urinary tract confirmed the findings obtained by ureteral catheterization. Pyelography also gave us the information that a marked dilatation of the renal pelvis and ureter (Fig. 4) existed. At operation it was of interest to observe that the calculus was relatively so small and the lumen of the



Fig. 7. Pyelograms from two cases of inflammatory dilatation of both renal pelvis and ureter. Note typical clubbing of calyces. In both cases abdominal pain was the outstanding symptom.

renal pelvis and ureter so dilated that it would not have been surprising to have encountered the shadow from day to day at any portion of the upper urinary tract. In passing I might add that pyelography is of the greatest aid not only in determining the location of a calculus within the kidney itself but also in giving much information in regard to the damage which the stone has done as I well illustrated in Figure 4.

The value of pyelourethrography in the diagnosis of ureteral calculus is fully equal to that which we have just seen in the case of a renal calculus. At the point of lodgment of a ureteral calculus there is visible (a) either a nodular widening of the ureterogram or (b) a lighter area as shown in Figure 6. At the same time one is able to confirm the diagnosis of a true intra-ureteral shadow by observing (Fig. 6) the degree of dilatation of the ureter above the obstructing calculus as well as dilatation of the renal pelvis itself.

The importance of such data cannot be overestimated in the differentiation of pain which is due to an appendicitis from that which is incident to the presence of a ureteral calculus. Of course the possibility of the co-existence of both conditions must not be overlooked.



Fig. 8. Pyelograms of two types of hydronephrosis (no chemical and inflammatory). (left) Marked dilatation of pelvis and major calyces as result of mechanical obstruction at pelvic outlet. (right) Marked dilatation of pelvis, major and minor calyces—result of long standing infection of entire upper urinary tract (note dilated ureter).

#### URETERAL STRICTURE

Although I am not willing to agree with Hunner as to the frequency of this condition especially in the female I do concede that many useless operations have been in the past and are still being performed because a stricture of the ureter was overlooked. To depend however upon instrumental examination alone without confirmatory evidence in the form of a ureterogram or *vice versa* is, I believe a mistake. Not infrequently a stricture is complicated by calculus formation and here again the combined investigation with a



Fig. 9 Ureteropyelograms in movable kidney (left) Kinking of ureter and displacement of kidney & Typical torsion of kidney and kinking of ureter & pelvical outlet

ureteral bougie and a ureterogram will give much valuable information from both the standpoint of diagnosis and prognosis.

The coincident presence of a true intraperitoneal lesion in the form of a cholelithiasis and of stricture of the ureter is well illustrated in Figure 6. In this case a cholecystectomy and appendectomy was followed by recurrence of pain in the right lower quadrant which was relieved only after treatment of a ureteral stricture.

### INFLAMMATORY AND MECHANICAL DILATATION OF ALL VARIETIES OF THE URETER AND RENAL PELVIS

There are many cases in which abdominal pain is due to one of the above. The resultant stasis favors an already present infection or offers a favorable medium for the lodgment of organisms excreted by the kidney. In the early stages it is much easier to make a diagnosis of the underlying cause of the dilatation than at a later period. This is well illustrated in Figs 7 and 8. In both of the cases shown in Figure 7 abdominal pain was the predominating symptom. The instrumental (cystoscopy etc.) findings were confirmed by the ureteropyelogram which revealed incipient inflammatory changes. In the two cases shown in Figure 8 the changes as shown in the ureteropyelogram are far more advanced. One of these (a of Fig 8) was not relieved after appendectomy performed by an experienced surgeon who had failed to study the case with the possibility in mind of a renal



Flu a

Fig. Large hydropneumothorax of right hemithorax. Dr. J. D. J. Semmlinger, gall bladder disease. Case examined for Dr. C. E. Kahle.

condition being the cause of the clinical picture. The other (b of Fig 8) shows inflammatory dilatation not only of the renal pelvis but of the ureter as well. In both cases the diagnosis was cleared up by the ureteropyelogram and other urological studies.

### MOVABLE KIDNEY

Another frequent source of postoperative dissatisfaction on the part of both surgeon and patient is persistence of pain due to an overlooked abnormal mobility of the kidney with resultant kinking of the ureter. I cannot emphasize too strongly the necessity of having pyeloureterograms made of obscure abdominal cases in the recumbent and upright position in order to determine with accuracy the degree of mobility and of hydronephrosis due to ureteral obstruction from a kinked ureter in a movable kidney. In the pyelogram shown in Figure 9 this last named condition is especially well shown in b of the illustration. The resultant obstruction to the



Fig. 12. Lateral pyelograms in renal neoplasms. *a* Filling defect of upper major calyx with displacement of kidney down and (note kinked ureter) in case of hyperplasia of upper pole. Principal symptoms abdominal pain. *b* Distortion and dilatation of upper major calyx in polycystic (fragmented) kidney. Principal symptoms pain and tumor. Opposite kidney shows same condition.

escape of the urine will sooner or later end in the formation of a well-marked mechanical hydronephrosis as is shown in the pyelogram of Figure 10.

This case presented a history like that of a recurrent cholecystitis probably with calculi. Dr. C. I. Kahle, however, suspected some involvement of the urinary tract on account of the history of the pain during attack, being most marked in the right lower quadrant. I was a led to study the case from the urological viewpoint.

The pyelogram revealed an advanced hydronephrosis of a movable kidney lying in the right iliac fossa.

#### RENAL AND PERIRENAL TUMORS

I have attempted to give you only a bird's eye view of some of the advantages of uretero-pyelography in the differentiation of abdominal pain and will close by a brief reference to its value in helping to distinguish between an enlargement due to neoplasm of the intraperitoneal viscera and those due to similar conditions in the retroperitoneal structures. The most important data given by ureteropyelography alone or with the opaque catheter are the following:

1. Displacement of the ureter inward or outward usually by a retroperitoneal neoplasm, either a sarcoma of the lymph nodes or a neoplasm of the kidney itself or of the immediately adjacent structures. In the case

shown in Figure 11 the clinical diagnosis had been placental tumor. The roentgenograph after injection of the contrast solution into the kidney pelvis and the use of an opaque catheter revealed a marked outward displacement of the ureter and a rotation and compression of the renal pelvis and its major calyces. The diagnosis was changed to perirenal neoplasm and at operation an advanced retroperitoneal sarcoma was found.

2. Filling defects or distortion in the form of elongation or compression of the renal pelvis and its calyces. This is the typical finding in intrarenal neoplasm but may occasionally occur in a perinephritic abscess as Dr. Kell observed in a recent case.

In *a* of Figure 12 one sees a typical filling defect from which a diagnosis of tumor of the upper pole of the kidney was made before operation and confirmed at the latter. In *b* and *c* of Figure 12 are seen the bizarre pictures due to elongation and compression of the pelvis and calyces in bilateral congenital cystic kidneys. These compressions, distortion and elongations of the pelvis and calyces (Fig. 13) are the most common findings in all forms of renal neoplasms except those in which there is early obstruction of the pelvic outlet with resultant hydronephrosis. It is impossible in such a short paper to do more than point out a few of the advantages of ureteropyelography in abdominal diagnosis. I shall have accomplished all that could

be hoped for if only your attention has been directed to this most valuable adjuvant to our diagnostic resources

#### DISCUSSION

Dr CHARLES E. KANLAP. Dr Eisendrath has mentioned the main points in connection with the cases I had to deal with. In two of them particularly he was of great help making differential diagnosis between gall bladder trouble and hydronephrosis. One young lady came with the gall bladder and appendicitis but with the same old symptoms. The X-ray pictures were said to show no stone. I therefore thought we had a hydronephrosis to deal

with. Our picture however revealed a stone apparently normal sized kidney nevertheless pyelogram showed hydronephrosis and hydro-ureter as well. We made a nephrectomy and ureterectomy but in doing so accidentally opened the sac which we were dissecting from the duodenum. As I felt no stone on digital examination, I opened the recter lower down and passed a large sound into the bladder after which the ureter was ligated in the pelvis and removed. A later X-ray picture showed the stone down near the esical orifice of the stomach. As we were afraid to leave the stone and as it seemed unwise to use forceps through the cystoscope on account of the danger of pushing the stone through the upper end of the stump we extended our original incision down and removed the stone extra peritoneally. I can corroborate what Dr Eisendrath said about the importance of urograph.

Dr VICTOR C. SCHIRAGOFF. I was called to see a case which the physician had diagnosed as appendicitis, but the order of symptoms of appendicitis was not typical. One of the greatest contributions to the surgery by Dr Murphy was his picture of the



Fig. 3. Tracing of pyelogram in hypernephroma. Distortion of pelvis and calyces by the morbid mass caused such pyelograms to be given name in spider or dragon. (Case of Drs. Derge and Ziegler.)

order of symptoms in cases of appendicitis. He pointed out that if the succession of symptoms was not perfect the diagnosis is doubtful. In the case I speak of a number of examinations were made and the patient was dismissed as negative so far as appendicitis was concerned. About 7 months later the patient developed an abdominal syndrome simulating appendicitis. At this time I had better control of the patient and had urologist examine him and he found the man had a stricture of the ureter with hydronephrosis and hydronephrosis which simulated appendicitis.

I had another case of acute abdomen simulating appendicitis in a child 5 years of age. The patient was taken to the hospital a careful study of the case made, and we decided on diagnosis of hydronephrosis. At the operation we found hydronephrosis and solitary kidney.



# DEPARTMENT OF TECHNIQUE

## CESAREAN TECHNIQUE

By G. S. JOSEPH, M.D. MANCHESTER, N. H. HARRINGTON  
Surgeon, New Haven Hospital

THE success of cesarean section seems to be in direct ratio to the perfection of the technique of the operation. Like operations for other surgical conditions, there are very many methods developed by various operators all of which prove quite successful. Wherever a technique for any operation is so far developed by the operator as to eliminate hitches and errors, like pathological conditions are bound to give practically equal results.

For several years we have used in our clinic a technique for cesarean section which has proven most satisfactory in every detail. The success in this class of cases has seemed pronounced enough to warrant a description of the *modus operandi*.

No narcotic is given to the mother pre-operatively as it has seemed markedly to influence early reactionary activity on the part of the

child. The child was cyanosed and did not breathe as early as times requiring artificial respiration.

All cesarean patients are fully prepared and draped ready for the incision before any anesthetic is given. For all cases up to the time of delivery of the child and placenta we have used gas oxygen only. This is done to assist the child rather in becoming active in the reaction immediately upon delivery. For gas oxygen does not seem to influence the child in any way. Shortly after the gas oxygen is started the anticipated line of incision is thoroughly anesthetized with a half of one per cent novocain solution, each layer being carefully covered.

Just as the incision is begun 30 minutes of ergotal with 1 cubic centimeter of pituitrin is injected deep in the thigh muscles.

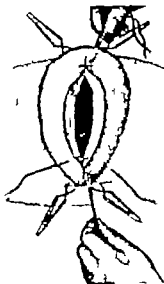


Fig. 1. The assistant begins the suture of the uterus at the upper end of the incision, the operator at the lower end. A long, straight, cutting-pointed needle threaded with No. 40 chrome catgut is used.

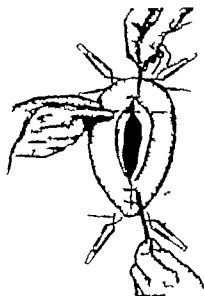


Fig. 2. As soon as the sutures are passed they are tied and held by a second assistant. As each succeeding suture is tied and held below and above, the preceding ones are cut.

We like a rather long median incision extending from the umbilicus to the pubic crest as this permits of plenty of room for quick and accurate action. The skin, fascia, muscle, and peritoneum are thus quickly incised. As soon as the abdominal cavity is opened towels moistened with warm saline solution are dropped over the lateral edges of the wound cutting off any danger of apposition of these parts with the uterus or exposure of the intestines. These towels are carefully anchored at frequent intervals about the wound.

The hand is then introduced into the abdominal cavity and the position of the uterus quickly surveyed to make sure that the median line of the uterus is in the same plane as the median line of the body.

The uterus is then incised. A previously unused scalpel is employed for this, as was also done when incising the peritoneum. We rather adhere to a moderately high incision believing that it permits of more accurate and quick delivery of the child. No attention is paid to constricting the vessels of the broad ligaments. As the amniotic sac bulges it is quickly opened, divided with the fingers, one under spreading each angle of the opening.

The presenting part of the child is then gently grasped and the child delivered, cord clamped and cut, and the baby turned over to the pediatrician for immediate care. The placenta is then carefully delivered by gentle separation of the cleavage line with the pulpy part of the finger tips. It is made sure that every part of the placenta is delivered.

So far in the operation there is very little loss of blood, not over  $\frac{1}{2}$  to ounce. Immediately

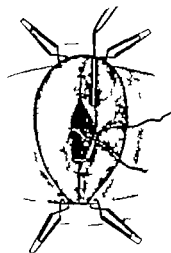


Fig. 4. Three mattress sutures include both sides of the incision and when tied infold and cover over the first line of sutures and the incision. The suture line is thus strengthened and the uterine wall reinforced.

upon delivery of the placenta the uterus contracts under the influence of the ergotol and pituitrin and all oozing ceases. Clean towels are then quickly draped about the wound and anchored.

The uterus is quickly brought out onto the clean field and all areas mopped dry and the suturing begun, the assistant beginning at the upper extremity and the operator at the lower extremity of the uterine incision using a long straight, cutting pointed needle threaded with No. 3 chromic catgut. These sutures are passed through the entire thickness of the uterine wall with the exception of the mucosa. As soon as the sutures are passed they are tied and held both below and above by a second assistant. Thus the uterine opening is held taut and closed. These sutures are passed about a half inch apart and as each succeeding suture is tied and held below and above the preceding ones are cut. In this way rapid and accurate progress can be made while any bleeding is noticeable by its absence.

After completing this line of sutures, three mattress sutures include both sides of the incision and when tied infold and cover over the first line of sutures and the incision. By so doing the first line of sutures is buried the suture line strengthened and the uterine wall reinforced.

On completion of the mattress sutures all areas are fully dried, special attention being given the space of Retzius and the vesicocervical superior plane. The uterus is then replaced in the abdomen. Following this, the peritoneal edges are quickly picked up at various points and made

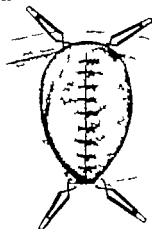


Fig. 5. The first line of sutures completed.

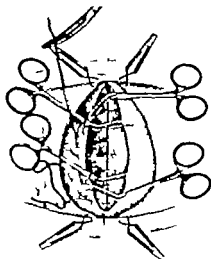


Fig 5 The peritoneal edges of the wound are quickly packed up at various points and made ready for closure

ready for closure. In closing the peritoneum a continuous mattress suture of No. 2 chromic catgut is used locking each third stitch by a half hitch. By this method rather than by suturing the raw edges of the peritoneum together the marginal area for about a half-inch is sutured to the uterus about the infolding line of the latter. By so doing the suture line of the uterus remains freely exposed and the peritoneum adheres to the uterine wall about it. This suture is made for two purposes. It permits of the formation of an improvised, accessory suspensory ligament for the uterus and provides for subsequent cesarean operations without the direct opening of the abdominal cavity. The abdominal cavity becomes so walled off that subsequent cesarean sections are extra abdominal in so far as exposing the intestines or abdominal cavity is concerned. Subsequent cesarean sections in cases closed in this manner warrant our continuation of the use of this closure of the peritoneal cavity.

The fascia is closed by a reverse lapping stitch and the skin closed by three through-and-through silk worm gut sutures and a continuous skin-edge linen suture. Just before closing the skin the wound is rinsed with sterile water and after being carefully dried a culture is always made before the skin edges are brought together. This culture taking is carried out not only in cesarean but in all closures of previously clean wounds merely as a check upon our asepsis. In cesarean cases we also culture the mucosa of the uterus.

A light dressing covers the skin closure and the

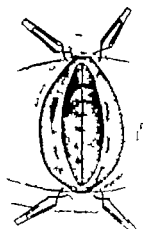


Fig 6 The peritoneum is closed by continuous suture of No. 2 chromic catgut, each third stitch being locked by half hitch

patient, then nearly conscious, is returned to bed. Individual cases all now and then require certain slight modifications of this technique. Some patients will strain after the child is delivered and will then, but never before this time, require a little ether vapor mixed with the gas oxygen. We have found that about 1 in 5, or 20 per cent, of the cases will demand a little warmed ether vapor.

In cases where vaginal examination has been made we prefer to leave a short inch gauze sock drain through the cervical canal to the vagina. This is removed on the third or fourth day. If multiple vaginal examinations have been made, and especially by more than one physician, we leave a cigarette drain which is removed the fourth day in the lower angle of the abdominal wall incision extending down to the vesicocervical plane and space of Retzius. Whenever any doubt exists, we use one or both of these.

The above described technique while simple should warrant approval because during the past decade we have had only two deaths. One of these patients died of sepsis because we had used poor judgment in not instituting drainage. The other died of postoperative pneumonia. This patient required complete ether anesthesia for the second half of the operation and for years past had been an invalid from endocarditis. There was no infant mortality.

Special emphasis is placed on the method of re-enforcing the uterine incision and the establishment of an extraperitoneal route for subsequent cesareans.

FASCIA PPLICATION IN THE REPAIR OF INGUINAL HERNIA<sup>1</sup>

BY JOSEPH A. PETTIT M.D. FACS PORTLAND OREGON

In working out a method of performing herniotomy we have tried to follow in this work the general principles of plastic surgery, under which heading herniotomies really belong. We have tried to figure out a plan of transplanting the cord, which has always been the serious impediment to securing firm union, so that it may be removed entirely from the weak point of the operative repair without disturbing its function.

For a number of years we have used a surgical technique which has seemed to give a maximum result and we feel that fundamentally this technique is in accord with the basic principles of plastic surgery, and at the same time functionally and anatomically correct.

Our technique may be briefly described as follows:

The skin incision is usually made on a curve, with the convexity upward one end not far from the pubic spine and the other end approaching the other part of Poupart's ligament. An effort is made to place the skin incision as high as practical above Poupart's ligament. When the incision is made with the convexity upward the flap can be reflected downward. This procedure keeps the skin incision at a maximum distance from the groin at which point it is difficult to fasten the dressing so as to protect the incision from contamination. The straight incision close to Poupart's ligament is sometimes partially exposed because the dressing works upward when the patient moves in bed. For the postoperative dressing an antiseptic gauze is used. The lower border of the dressing is sealed down by collodion.

Better results may be expected if the principles of plastic surgery are followed in performing herniotomy. The fibrous tissue which makes up the fascial layers are the supporting tissues of all parts of the body. The muscles of the extremities, as well as of the trunk, are held in place by fascial envelopes and wherever cavities exist without a bony enclosure we find an osseous substitute in the fascia. So in the lower part of the abdominal cavity we find the basic element of permanent support to be the fascia. In repairing any ventral hernia of the abdominal cavity we depend upon fascial plication for securing permanent closure. Sutured muscle fibers do not resist constant strain or pressure while sutured ligaments and aponeuroses, especially if re-enforced

by overlapping will endure and withstand constant stress and strain. In fascial plastic repair work we can learn a lesson from the principles of bone surgery, namely that to secure a firm osseous union it is necessary to make an accurate contact of osseous elements, which means that the fatty tissue and the areolar tissue must be thoroughly and completely removed from the coaptating fascial surfaces. To enhance additionally secure fascial cohesion, the principle of overlapping can be successfully employed. In the suturing of hernia whether ventral umbilical or inguinal, this principle should be borne in mind. The technique of our operation is based on the principles of plastic surgery as applied to other parts of the body and an endeavor is made to secure as broad a plication of the fascia as possible at the weak point of this type of hernia, viz., the external ring, and to bring the cord from the abdominal cavity to the outside, at a point high up where it will the least endanger the permanency of the repair. In addition to this, it is brought out in such a manner that it comes through a new fascial canal in a direction to produce the least impediment for a complete fascial overlapping. With the cord placed in the position shown in our illustrations it is almost impossible for the peritoneum to protrude from the abdominal cavity for the following reasons. In the first place, the cord comes through the internal oblique and transversalis muscles at their strongest point of attachment to Poupart's ligament. In the second place, an angulation occurs here which does not interfere with the circulation of the cord, and is a definite barrier to a hernial protrusion. In the third place, a hernial protrusion seldom occurs following a tortuous course through parietal structures. In the fourth place, with every strain a definite pressure is exerted upon the new canal of the cord through the fascial layer. This strain is not enough to interfere with the circulation of the cord but is sufficient to restrain a potential peritoneal protrusion.

In splitting the fibers of the external oblique from the internal ring upward, it would seem advantageous to split the fibers as far from Poupart's ligament as possible in order to give a long inferior flap for plication over the superior flap. By splitting the fibers upward from the external ring beginning at the uppermost part of the external ring, the most extensive plication is se-

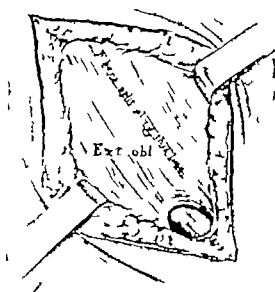


Fig Splitting of fascia above Poupart's ligament

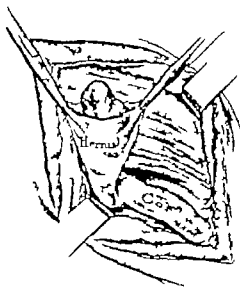


Fig High dissection of sac

cured. The higher the line of incision is made in the external oblique, the greater will be the width of the inferior flap, and the surfaces for plication will be that much broader, thus insuring the largest surface and the greatest assurance of permanent secure union. We feel that a plication of greatest width possible gives the greatest surety for permanent and secure union. Broad plication is better fortified against some undue or early strain and a complete separation is less apt to ensue if some early stress or later heavy tension does occur.

A greater length of the spermatic cord is required for this plication technique than for the ordinary herniotomy. Experience has demonstrated that no difficulty is encountered on this account if the cord is loosened up low down toward the scrotum, as well as high up, through the internal ring. It will often be noted that immediately following the operation, the testicle is held considerably higher in the scrotum than before the operation, but it gradually gravitates to a relatively normal suspension point.

There is a difference of opinion in regard to the importance of the so-called high dissection of the sac. No dependence can be placed upon the peritoneum for strain bearing, and if the essential parietal structures are not adequately repaired the peritoneum will not stand the strain

alone. It would seem advisable, however, to make as high a dissection of the sac as can be conveniently made, clearing away any lumps of preperitoneal fat, and it has always seemed antagonistic, at least from a psychological standpoint, to anchor the stump of the sac at a point higher than the internal ring. By ligating the sac with a suture then passing the blunt end of the needle through the muscle fibers of the internal oblique and transversalis muscles and the fibers of the upper flap of the aponeurosis of the external oblique at a point which will contact properly, and tying the ligature externally the stump of the sac can be at least temporarily anchored and possibly permanently held by scar tissue at a point higher than the internal ring.

The longer the lower flap of the external oblique is made by a high splitting incision from the external ring, the greater is the breadth of plication possible. The surfaces of both these flaps should be thoroughly cleansed from fat and areolar tissue so that their coaptation will be precise and firm.

If the lower flap of the aponeurosis of the external oblique is plicated beneath the upper flap, as is advocated in the Skilleen operation, we find two distinct disadvantages: (1) it is not possible to make so extensive a plication; (2) it is not possible to construct a new fascial canal for the struc-

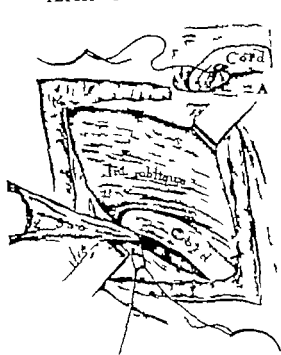


Fig 3 High ligation of sac

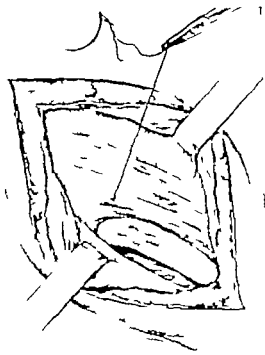


Fig 4 Anchoring the stump of the sac at point higher than the external ring

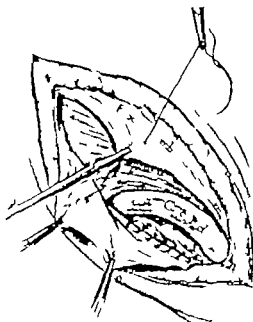


Fig 5 Note suture of muscle to shelving edge of Poupert ligament. Passing the needle through the fibers of the upper flap of the powerful makes the sac anchorage more secure.

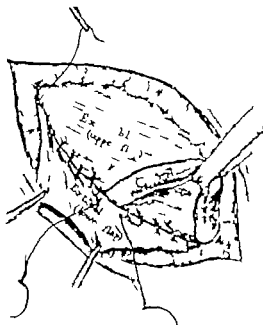


Fig 6 Edge of upper flap of fascia sutured to Poupert's ligament separately on each side of new canal. The new internal ring is identical to the muscle and at this point of the fascia.



Fig. 7. Lower flap plicated over upper flap and separately sutured on each side of cord. Note new fascial canal and breadth of canal.



Fig. 8. Fatty layer structure makes soft cushion over cord, and high curved incision in the skin removes the wound maximum distance from possible source of contamination.

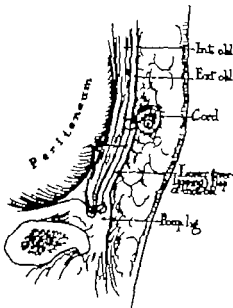


Fig. 9. Transverse section of completed spongy Ventral Hernia. Pettit.

tures of the cord without producing an additional sharp and disadvantageous angulation.

By suturing the border of the upper flap low down on Poupart's ligament beneath the lower flap (after suturing the internal muscles and the conjoined tendon) the new internal ring is identical in the muscle and at this point of the fascia. There occurs only one angulation which is not sharp or disadvantageous. When the cord comes out of the new external opening, high up the angulation is neither sharp nor disadvantageous there.

If the lower flap is plicated over the upper flap, as has been done by us for a number of years, we find it possible, ( ) to make the broadest possible plication and this insures permanency of the closure ( ) not only to eliminate one angle for the cord, but also to eliminate any sharp angulation which might be detrimental to the integrity of the functions of the structures of the cord, for the newly constructed fascial canal has its angle at the uppermost point of the normal internal ring where it normally emerges, and has a pad of soft muscle structure on which to turn then coursing upward and emerging by a slight turn to the outer surface of the external oblique.

There is a diversity of opinion regarding the type of suture for herniotomies. Many have faith in the security of interrupted sutures individually tied. Here again, we may learn a lesson

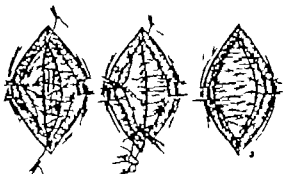
from the general principles of plastic surgery namely the fewer buried knots there are the better because of (1) the slowness of knot absorption with the possible danger of sloughing out, and (2) the possible danger of constriction from tying. The running suture accurately placed favors ready absorption and is adequate to hold for the length of time required for fascial cohesion. The running stitch does not produce the constriction that a single tie does. Double chromic catgut of not too heavy size, thoroughly tested before using, will endure much longer than necessary for fibrous tissue cohesion, and with its use the number of knots needed is reduced to a minimum. We apply the running suture in such a way as not to cross the new fascial canal. Thus there is no pressure from a suture on the structures of the cord. We tie the sutures on either side of the new canal. As a rule we sew the flaps separately above and below the cord, most frequently using the same continuous suture for suturing the lower border of the upper flap to Poupert's ligament, plicating it along the flap and then continuing for the suture of the upper border of the lower flap to the external surface of the aponeurosis above. The same technique is used for plication of the flap above the cord and thereby we finish with but two knots on each side of the new canal for the cord.

Careful suture of the fatty layer structure, with the outline of the visible fibers of the superficial fascia in mind, (1) gives a soft pad covering for the cord as it lies on the deep fascia, and (2) eliminates any dead spaces as such frequently hold a blood clot, which fails to absorb normally. It has seemed advantageous to suture the fatty layer with a running suture. We introduce the suture first through the skin and it emerges again on the skin at the other end, thereby avoiding a buried knot in the fatty layer.

The same loose ends can be used for closure of the skin.

#### CONCLUSIONS

1. If the general principles of plastic surgery are applied in operating on inguinal hernia better results may be expected.



FIGS. 1, 2, AND 3. Fascia plication of central hernia involving principles employed in inguinal hernia technique.

2. The sustaining tissue in such operations is fascia. As the fibers are sewed longitudinally they have a tendency to spread, especially if the fascia is already attenuated. A very complete plication or overlapping (a) insures a maximum permanency of security and (b) avoids the tendency of the fibers to spread.

3. By high transplantation of the cord in the new fascial canal, the possibility of another peritoneal protrusion is minimized.

4. The position and direction of the new fascial canal conserves the integrity of the structures of the cord without hindering in any way the greatest degree of overlapping of the fascial layers.

5. The type of suture described gives a minimum amount of constriction to the fascial fibers and at the same time a maximum coaptation.

6. To secure an early as well as firm fascial cohesion it is important to cleanse the fascial surfaces thoroughly of all fat and areolar tissues, otherwise the sutured areas may slip as would a pseudo-arthritis.

7. The high curved incision in the skin and fatty layer removes the wound the greatest distance from possible sources of postoperative contamination.

8. Some kind of antiseptic gauze sealed to the skin below with collodion, additionally safeguards against postoperative wound infection.



## THE USE OF WAX MODELS IN THE TEACHING OF SURGERY

EXEMPLIFIED BY A SERIES OF MODELS SHOWING YOUNG'S PERINEAL PROSTATECTOMY

B. FRANKLIN F. JOHNSON, M.D., PORTLAND, OREGON.

From the Army Medical Museum, Baltimore, Maryland.

FROM the standpoint of the medical student there is perhaps no other branch of medicine in which the teaching is less satisfactory than in operative surgery. The chief reason for this is the fact that the student is able to see so little of the important steps of an operation with our present day system. When the class is large only a favored few are close enough to make it worth their while to sit through the entire operation, and even these few are fortunate if the operator's hands or his assistants do not completely block his view at the most critical point in the operation. It is no wonder, therefore, that after the first few weeks, the attendance of the surgical classes gradually falls off or that the students who attend often do so for the purpose of making up lost sleep or reading the morning newspaper.

The value of models as an aid to the teaching of anatomy and embryology has long been recognized, and we are all more or less familiar with the commercial products of Ziegler's, Trammann's, Rouppert's, and Ward's laboratories. In addition to these one sees in almost every anatomical laboratory numerous home-made models usually constructed after the Born's wax plate method. There are of great aid to the student in helping him to visualize and fix in his mind complicated anatomical structures and the intricate developmental processes. In courses in pathology models are used to some extent, but an increase in their use would certainly result in benefit to the student. The beautiful and carefully made dermatological models in the Army Medical Museum clearly demonstrate the value of models in this branch of medicine.

However in this country practically no attention has been paid to the application of this method in the teaching of operative surgery. To demonstrate an operation, the surgeon has relied upon diagrams, drawings which are often distorted, and photographs which are usually none too clear. Stereoscopic photographs have been used with some success and more recently motion pictures have been tried. All of these are valuable methods but they cannot compare with a graded series of models showing the operation step by step. For in carefully made wax models, size,

shape, and color can be shown without exaggeration or distortion, and what is equally important things are shown in their three dimensions. More over models can be handed from one student to another and the details studied minutely at leisure.

It was because of the student's difficulties that Dr. Hugh H. Young suggested to me the preparation of a series of models showing a perineal prostatectomy. The operation which is shown in the accompanying figures is an imitation of that performed by Dr. Young routinely at the Johns Hopkins Hospital. The actual modelling has been done by Dr. V. Fortunato who has developed a technique by which he can prepare models which are as true to life as it would seem possible to make them. His models comprise faithfulness of reproduction in form, color and texture as well as durability; they must be seen to be appreciated.

Briefly the method of preparation of the models can be stated as follows: The portion of the surface of the body to be modelled is shaved and coated with a thin film of mineral oil. A thick layer of dental plaster of Paris, properly mixed with water is then carefully spread over the part. The plaster is allowed to harden and the mold, a negative, is lifted off. After the mold has been allowed to dry at room temperature for 3 or 4 days, it is then soaked in cold water until it is thoroughly saturated. Any excess water is sponged from the surface with absorbent cotton, and the mold is immediately filled with melted wax. The formula of the composition used by Fortunato, I am unable to give as this he holds in secrecy. Unlike wax, the composition after thorough hardening is durable and not easily indented or broken.

For the preparation of the model shown in this paper a suitable cadaver was secured through the kindness of Dr. Lewis A. Weed of the anatomical department of the Johns Hopkins Medical School. As the operation progressed it was stopped at various points and plaster impressions taken. Retractors and other instruments used were held by assistants as in the operation on the living subject. From these molds the models were cast. Details of structure, and the color and texture of the various tissues were carefully studied in the

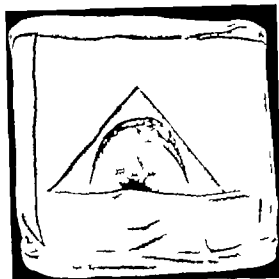


Fig. 1 The first model shows the method of draping the perineum and the initial skin incision. The exposed area is about 5 inches broad and 3 inches in height.

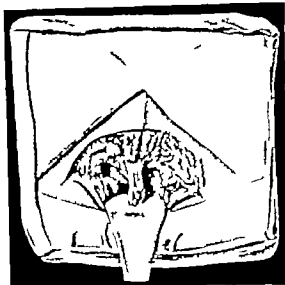


Fig. 2 The central part of the lower flap is fastened to the edge of lower towel by an Allis clamp which acts as gentle retractor and serves to cover the anus.

operating room and were added later. The retractors were made of composition and covered with a thin layer of metal foil. Models of the gloved hand shown in the figures were made separately. In all, twelve models were made. These were mounted on specially prepared boards painted black, three models to each board. Draperies, saturated with a chalk-like paste, to insure their permanency, were added last.

While it was my intention at first merely to show and describe the models rather than to describe the operation, I have found this to be not only difficult but unsatisfactory. I have included in my description, therefore, certain points concerning the operation which could not be shown graphically and others which may help link together the steps of the operation.

Although the success of the operation depends in a large measure upon the preliminary treatment of the patient, it is not the province of the present paper to go into its discussion. The whole matter of catheter drainage, the forcing of fluids, the importance of waiting until kidney function has reached its peak as determined by the phenol sulphophtalein test and study of the blood chemistry, the special measures and precautions to be taken when other complicating diseases occur are matters which have been fully discussed elsewhere.

I shall therefore begin my description with the patient on the operating table in the perineal position, with thighs and knees flexed, legs spread apart, the perineum elevated and the head lowered.

**Model.** The first model shows the method of draping the perineum and the initial skin incision. Before draping, curved sound usually No. 8 or 10 F. is passed into the posterior urethra and is held in place by an assistant. Three towels are then placed across the perineum so as to form an isosceles triangle, the apex of which is at the scrotoperineal junction and the base at the level of the anterior margin of the anal orifice. The exposed area is usually about 5 inches broad and 3 inches in height but varies with different shaped perineums. The draping is completed by means of perineal sheet.

The incision is the shape of an inverted U. The model as it is about 1/4 inches in front of the anus. Because of the tension to which the perineum is subjected by the position, as soon as the skin is incised the wound gapes widely and the underlying fat is exposed. Usually the hemorrhage is slight and no ligatures are needed. (Fig. 1.)

**Model.** As soon as the incision is completed the central point of the lower flap is fastened to the edge of the lower towel by means of an Allis clamp. The clamp hanging down by its own weight acts temporarily as a gentle retractor and at the same time serves to cover over the anus, thus preventing contamination of the wound as the operation progresses. By blunt dissection with the tip of the forefinger, two flaps are developed, one on either side of the central tendon. The direction of the flaps is downward and slightly forward, following the inner surfaces of the pubic ramus. The flaps should be posterior to the transverse perineal muscles and about 3 1/2 to 4 inches in depth. When properly made the transverse perineal muscles should be left anterior to the urethra with the contained sound in the depths anteriorly, and the rectum posteriorly.



Fig. 3 The central tendon has been cut transversely.

A posterior labial retractor is inserted into the wound and ad-  
dressing the central tendon and membrane around it is then  
put upon it by an assistant. The central tendon is thereby  
put upon a street (Fig. 4).

Model 3. In this model the central tendon has been cut  
transversely. This structure composed partly of the peri-  
neal fascia, contains also a few muscle fibers derived from  
the external sphincter muscle of the anus and the transverse  
perineal muscles. Occasionally a small artery is cut  
with the central tendon which requires ligation. The cut  
end of the central tendon immediately retracts forward and  
backward and become lost from sight as the operation  
progresses. With the central tendon out of the way the  
rectum is brought into view its anterior wall being into

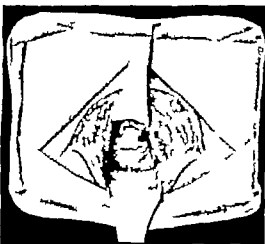


Fig. 4 The rectum has been cut by transverse incision.

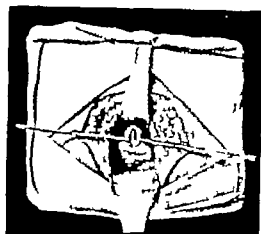


Fig. 5 Incision into membranous urethra at apex of prolap.

the groove of the labial retractor. Anteriorly the rectum  
is firmly fixed to the membranous urethra by means of the  
recto-urethral muscle the fibers of which can be demon-  
strated without difficulty by means of little dissection.  
The bulb of the urethra covered by the bulbospongiosus  
muscle and thin layer of fascia, is usually not seen. It lies  
beneath the fat and deep perineal fascia just anterior to the  
cut end of the central tendon. The exposure of the bulb  
may be attended by rupture and hemorrhage, which  
difficult to control, and is more important, the possi-  
ble injury to external sphincter muscle of urethra (Fig. 5).

Model 4. In this model the recto-urethral has been cut  
by transverse incision. This permits the rectum to drop  
backward. The labial retractor is then exchanged for  
plate posterior retractor. These tend to flatten out the  
rectum. It is shown in the figure but great care must be  
exercised not to exert too much traction on the retractor  
as it will not directly upon the rectum. An anterior hold-  
er or bulb retractor is next inserted. If the technique is prop-  
erly carried out the retractor should be placed behind the  
free edge of the triangular ligament and should pull it far  
and (the same time protecting the external sphincter  
muscle and bulb of the urethra). The membranous urethra  
distinguishable by means of the sound (Fig. 6), is now ex-  
posed. Occasionally Cooper's glands are brought into  
view, more often they are pulled forward beneath the blades  
of the retractor. Their removal is of no importance in  
the operation (Fig. 6).

Model 5. This shows the incision into the membranous  
urethra (the apex of the prolap) accomplished by means of  
median longitudinal incision about one half inch in  
length. The point of the knife is firmly pressed against the  
sound to open the membranous urethra. The cut edges  
of the membranous urethra are then closed with the  
clamps. Care taken to include the mucous membrane so  
that when the sound is removed the lumen of the urethra  
will not be lost. The curved sound is next withdrawn from  
the urethra and straight sound is then introduced through  
the incision in the membranous urethra. This should pass  
without difficulty but the bladder taking forward and  
downward course. The straight sound is then withdrawn  
and a long prostate tractor is passed out the bladder.  
The blades of the retractor are opened and the set screw hold-  
ing them in this position is tightened (Fig. 7).



Fig. 6 The posterior surface of the rectum is retracted backward and shielded by the posterior retractor

**Model 6** By means of the tractor the prostate is now pulled up and out the wound, its exposure being aided by means of the lateral retractors. Covering the prostate posteriorly and lying between it and the rectum are the layers of the fascia of Denonville. The anterior layer is quite firmly adherent to the posterior capsule of the prostate, the posterior to the rectum, but the layers are only loosely joined to each other. These layers are separated by first making a very shallow incision through the posterior layer at the apex of the prostate (preferably at one side of the midline) and continuing by blunt dissection. There is usually no mistaking the proper line of cleavage, for when the posterior layer of fascia is stripped back, and the anterior layer appears as a white glistening covering of the prostate. As the rectum is more adherent laterally than in the midline it is necessary to loosen these lateral attachments by blunt dissection. The incision is continued posteriorly to the base of the prostate. The posterior retractor is now reinserted in the space between the separated layers of the Denonville fascia and pulled down firmly. The posterior surface of the prostate is now fully exposed and the rectum is retracted backward and shielded by the posterior retractor (Fig. 6).

**Model 7** This shows the inverted V shaped incision into the posterior lobe of the prostate. The incision is made by beginning laterally on each side of the prostate and continuing upward and medially toward the apex of the prostate. The incision thus made connects with the posterior end of the incision into the membranous urethra through which the prostatic tractor passes into the bladder. In making the incision it is important to make it deep enough so that the prostatic urethra is cut on each side. This is done by cutting through all the tissues down to the shaft of the tractor. This procedure protects against the tearing of the floor of the urethra and injury to the crumomastom and ejaculatory ducts (Fig. 7).

**Model 8** As soon as the inverted V shaped incision is completed the triangular flap of the posterior lobe retracts

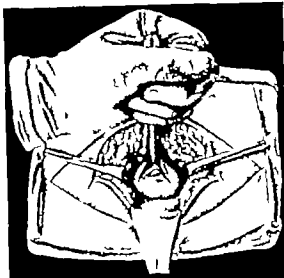


Fig. 7 Inverted V shaped incision into posterior lobe of the prostate

and falls backward, giving a view of the floor of the prostatic urethra with the crumomastom in the center. Care is taken not to injure this structure by too strenuous sponging.

The model (Fig. 8) shows the beginning excision of the adenoma. With the blunt dissector the line of cleavage between the posterior lobe of the prostate and the fibrous capsule of the adenoma is sought. This is not difficult to locate as the adenomatous tissue is lighter in color and stands out by contrast against the deeper red color of the prostatic tissue. The excision is begun with the blunt dissector on both sides. The instrument is carried around each lateral lobe here meets anteriorly with fibrous

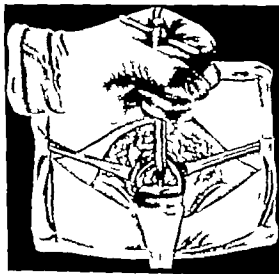


Fig. 8 Beginning—the excision of the adenoma

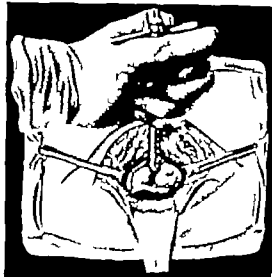


Fig. 9 The left lateral lobe is lifted into view



Fig. 10 Completion of enucleation of adenoma

band on each side connecting it to the urethra. The handle of the tractor is lowered and with the scissors these bands are cut. This is done first in the removal of the lateral lobes and to prevent undue tearing of the urethra.

**Model 9.** Enucleation of the adenoma is continued with the finger. The left lateral lobe is freed laterally and posteriorly and is lifted into view as is shown in the figure. The finger is then swept around posteriorly to the right just behind the posterior commissure and the right lateral lobe is loosened in similar manner. If the anterior commissure is to be removed with the adenoma the separation is continued across the midline anteriorly and the anterior commissure stripped from the anterior surfaces of the lateral lobes. The finger is then placed posteriorly and separation of the lateral lobes from the base of the bladder begun. In every adherent case a large cautery is of great help at this stage. Enucleation of the median lobe is carried out in the same manner with the finger tip, the tractor being turned so that one of its blades keeps the median lobe from being pushed up into the bladder. In certain cases a spoon tractor replacing the blade tractor serves excellently to draw the anterior lobe up and and to facilitate its enucleation (Fig. 9).

**Model 10.** The adenoma is now freed except around the urethral orifice. Here it is held by the mucosa of the prostatic urethra. With the finger tip this is stripped away from the medial surfaces of the lateral lobes. It is then put on stretch and often appears as long cords extending from the bladder. It is split longitudinally caught with clamps cut transversely and ligated. The adenoma then slips free up on the shaft of the tractor. An attempt is made to preserve intact the mucosa of the prostatic urethra except the floor, containing the urethromusculum and the ejaculatory ducts. As soon as the adenoma is removed, the internal vesical sphincter contracts down upon the tractor as shown in the figure. The blades of the tractor are then closed and the instrument removed. If there is stone in the bladder it is removed at this stage through the vesical orifice (Fig. 10).

**Model 11.** The lateral edges of the vesical orifice are next caught by T Miss clamps, and soft rubber drainage

tubes the size of 30 F. catheter is passed into the bladder. The wound is now packed to prevent hemorrhage. This done with narrow strips of gauze. The folded end of one pack is placed between the tube and the vesical orifice, the edges of the orifice being held with the Allen clamp so as to prevent its inversion into the bladder. Another pack similarly placed on the opposite side of the drainage tube and the clamps withdrawn. Other packs are placed in the prostatic cavity and in the wound until the hemorrhage is controlled. Along with the packs is placed a No. 10 F. catheter which later serves for the insertion of oil thus facilitating the withdrawal of the packs. The bladder next injected with warm salt solution through the large tube by means of large piston syringe. Blood which has accumulated in the bladder is then washed out. After several washings the return flow should be almost clear if there is no intra-vesical hemorrhage. The posterior retractor being removed, the edges of the levator ani muscles are brought together by means of chromicized catgut suture to their normal position in front of the rectum (Fig. 11).

**Model 12.** This model shows the method of closure. The packs and tubes are pulled to one side of the wound and tied in place by means of silk suture. The posterior skin flap is drawn upward and closure is completed with silver skin clips. Loose gauze dressings is applied to the wound by means of T bander. The packs are removed after 48 to 49 hours. The large drainage tube is left in place for another half hour, then it is withdrawn if hemorrhage does not recommence. In small percentage of cases continued hemorrhage necessitates repacking.

#### CONCLUSIONS

The teaching value of the models herein described has already been demonstrated. They lend themselves as equally well to individual or group teaching. They give the student better idea of the operation than he could obtain in the

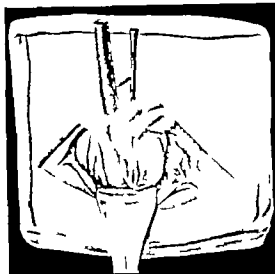


Fig Drainage tubes inserted and wound packed

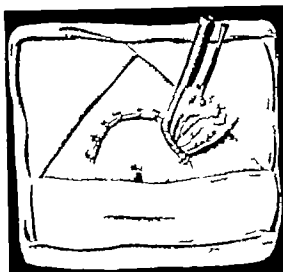


Fig Method of closure

operating room for at his leisure he can study all details without missing a single step.

Not only is modelling of value in surgery from the standpoint of showing operations, but the method can be used for other purposes as well. Tumors, ulcers, malformations, etc. if they present themselves externally are simple to reproduce in wax. The method is excellent for recording the results in plastic surgery for impressions can be taken before and after the several stages of operations of this kind. It was in this connection that the author became interested in modelling. A number of cases of hypospadias and other malformations of the external genitalia were modelled before and after operation and thus accurate records of the results obtained are made available.

These models of hypospadias, etc. are now serving as a nucleus for a much larger teaching collection which is being constantly added to at the Brady Urological Institute. It is proposed by

Dr. Young to have in the collection not only models showing pathological lesions and deformities, but a series of models such as is shown in this paper of all the important operations in urological surgery. At this time a second series of models showing Young's radical operation for carcinoma of the prostate is nearing completion.

I hope I have demonstrated that this method is as applicable to the teaching of surgery as it is to anatomy and embryology. I do not mean to imply that models of operations should supplant the surgical clinics, but used judiciously in conjunction with them they should prove a great help to the student.

I wish here to express my thanks to Dr. Fortunato for his painstaking labors and deep interest in the preparation of the models. For the generous supervision and valuable criticisms of Dr. Young and other members of the Brady urological staff appreciation is also expressed, and last, but not least, to Mr. William Dohrnack whose excellent crayon drawings of the models are reproduced in this article.

## CHIROPODIC SURGERY

## TREATMENT OF CHRONIC SUBUNGUAL HEMATOMA

BY DR. GUILLERMO BOSCH ARANA, BUENOS AIRES, ARGENTINA

Professor, Faculty of Medicine, Member of the Faculty of the University of Buenos Aires and Surgeon of Puerto Hospital

By chiropodic surgery (from the Greek *cheir* hand and *pous/podos* foot) is meant the specialty in the art of healing which is devoted to the extremities either hand or foot. It is a term used to designate preferably the cosmetic treatment of the extremities through minor surgery but not the wider field of those surgeons who specialize in the more extensive and important branches of the surgical art. Nevertheless, for etymological reasons, I have not hesitated to use the term in the title of this article, for the new chapter we are opening is of great interest to those who do cosmetic chiropodic surgery and to surgeons who may often be consulted for the treatment of an injury to the nail through a knock or a blow as from a hammer or a squeeze in shutting a door or a drawer. Hitherto, there has been no technically appropriate method for the treatment of subungual hematomata.

Opening the nail for the purpose of lessening the tension and avoiding very acute pains, is familiar to us as the method of choice in treating acute subungual hematomata.

In his book on minor surgery Dr. Milton Foote suggests cutting with a lancet across the root of the nail, and, in cases in which the nail has been raised by the injury and separated from the matrix, extracting it by freeing it from its lateral connection with the skin.

In his third volume on *Surgical Treatment* Warbasse confines himself to these words: "The best way to treat acute subungual hematomata is by trephining the nail over the hematomata. It causes no pain, relieves pain if present, and saves the nail by hastening healing."

In *Operative Therapeutics* (vol. 1, p. 569) D. Johnson states that treatment of acute cases consists in draining off the blood, thus preventing subungual tension. To accomplish this, he recommends the separation with a sound of the near nail root from its matrix until the blood drains off. Then he tells us to extirpate the nail 3 days later by raising it at the root and cutting it in the region of the hematomata. The bare surface of the derm left by extirpating the nail is isolated with collodion or adhesive plaster and, after waiting 2 weeks, the new skin repairs the damage caused by the surgeon.

These two quotations, the only references to this subject found in an extensive bibliography should suffice to convince my respected colleagues that no regular method of treatment nor practical study of subungual hematomata in either its chronic or acute phases exists and I therefore, claim the first fruits since I have conceived and perfected this new operation in the wide field of aesthetic surgery.

## INSTRUMENTS

The operative technique of unguis trephination presents no difficulty. It is simple and easy to do, but it is necessary to provide ourselves with appropriate instruments, which must be small to meet the needs of the injury, we are preparing to heal. The instrument are easily obtained. We procured them from the surgical workshop of the dentist. We use a small hand trephine (revolving head) which is practical and economical. The drill is a delicate, light instrument, which accomplishes the purpose for which it was made: allows of great precision, and affords at the same time lightness of touch. It would hardly be possible to use an electric drill to perforate the nail, but perforation is readily accomplished with the hand drill which easily grasps the horny layers of the nail. It is not necessary to exert as much pressure on the nail as the dentist must use when drilling a molar.

Two kinds of drills are used. The lanceolate and the round or wheel. Figure 1 shows the beginning of the perforation. Figure 2 the round drill perforating the nail. The drills are similar to those used by surgeons in trephining the skull, except that they are smaller, measuring only 1 to 3 millimeters in diameter.

We also use several exploratory dental stilettons, some rigid, others flexible. The former are hard, of tempered steel, elbowed, and curved, the latter are filiform and very flexible. We complete the surgical outfit with a water syringe, which is indispensable and of great practical value, and with another special syringe designed to hold hot, dry air.

Lastly we must have at our disposal a spatula and dressing-seal or temporary filling for the subungual cavity.



Fig. 1

Fig. 2

Fig. 1 Subungual hematoma. Double perforation of the nail at the periphery of the hematoma.

Fig. 2 Perforation with drill of the nail, half way between the ungual shield and the outside periphery of the hematoma.



Fig. 3

Fig. 4

Fig. 3 Beginning the cleaning out of the hematoma with stiletto.

Fig. 4 Syringe which acts in disintegrating the clot of blood.

#### ANESTHESIA

It is not necessary to use an anæsthetic in carrying out an ungual trephination, for the horny layers of the nail are quite insensible and once the nail is perforated, the subsequent proceedings do not cause any pain. However at the request of a timid patient, who displays a nervous temperament and declines to yield freely to the surgeon a local anæsthetic may be given.

#### TECHNIQUE OF TREPHINATION

Whether done to relieve pain in a recent acute case of subungual hematoma or for the cosmetic result in a chronic one, the technique used in trephining the nail does not vary.

In operating we must consider the extent and outline of the hematoma for the trephination is a double operation. Two perforations should be made close to the edge of the hematoma, one at the right side, the other at the left and at the same level, so that cleansing and removing of the solid or liquid blood in the cavity will be easy either in the chronic or acute case. First we use the lancetate drill (Fig. 1) to perforate the surface layer of the nail, then the ovoid wheel which perforates the bony nail as shown in Figure 2, slowly cautiously the wheel continues to drill until it reaches the subungual cavity which is revealed in acute cases by the flow of red blood, and in chronic cases by the appearance of hardened particles of blood, dark chocolate in color. The trephination terminates with a few more turns of the trephine.

The second perforation on the opposite side of the hematoma is immediately started and drilling continued until blood appears. In all our clinical cases patients declare that they have felt no pain or unpleasant sensation while the drilling was going on.

Simple trephination of the nail in acute cases should relieve the darting pains caused by the pressure from the hematoma, while the spontaneous rush of the blood through the orifice made

in the nail allows the displaced and compressed tissues of the subungual derm to return to their proper places and resume their correct anatomical positions. Thus the cavity is either reduced greatly in size or disappears.

In the recent or acute cases, trephination prevents the formation of a subungual hematoma. In such cases, one simple trephination will suffice for the relief of compression and for drainage. It is also possible by means of trephination to introduce by simple diffusion anæsthetic solutions, which, on reaching the subungual traumatic injury cause a complete subsidence of pain, an advantage which should be taken into consideration. We wait a week after the acute symptoms have been relieved before commencing the cosmetic treatment.

#### EMPTYING THE HÆMATOMA

A stiletto, with a small end elbow is inserted in the hole in the nail, and very gently the nearest portion of the subungual hematoma is extracted. In chronic cases the blood is found to be hardened and coagulated. The stiletto and must be placed between the deep surface of the nail and the hematoma. If this is done there is no danger of causing any pain, for we are far from the subungual derm which is the relatively sensitive part of the cavity. As we draw near the bed of the nail with care, patience, and a light hand, we can easily open a way between the nail and the solidified hematoma in the manner shown in Figure 3, and follow to the opposite trephined orifice. At this point the work proceeds as before until a subungual channel between the orifices is effected. After the subungual communication is established we must use other means to extract the hematoma, for if we continued to use the stiletto alone we might involuntarily cause pain by accidentally striking the bed of the nail, either through some extra effort on our part or through some defensive or reflex tactics on the part of the patient.





Fig. 5 (Left). Cosmetic filling of the cavity.  
Fig. 6. Result of cosmetic filling.

To obviate these serious drawbacks, we inject solvent liquids through the orifice while working with the stiletto and we have succeeded in introducing anesthetics like cocaine, thereby attaining satisfactory though not ideal results.

By means of the technique described—double trephination and the making of a subungual passage—all became plain sailing, for once the tunnel is opened we begin syringing to cause disintegration of the hematoma, making use of peroxide which is an antiseptic and a decolorizer, besides being active in causing disintegration of the hematoma. We fill a syringe with peroxide and flex its end alternately on either orifice, expelling the contents forcibly. The irrigation thus afforded disintegrates the hematoma little by little without the slightest pain or inconvenience to the patient.

At times, a piece of the hematoma, a little larger in size than the hole in the nail comes away. This may be directed or broken up with a stiletto cleverly handled inside the cavity. At times it becomes necessary to mollify to some extent the hematoma to be found in one block. The stiletto must always be inserted between the under surface of the nail and the hematoma. If this is done pain is absolutely avoided.

As the work of douching and disintegrating goes on, in case of necessity some anesthetic may be applied to act on the naked derm. We have been fortunate in not having had to use it and only mention it with the idea of making sympathies among our colleagues or capturing the sympathies and inclination of patients who might thus submit more willingly to the operation.

The peripheral portions of the hematoma break up with greater difficulty but gentle pressure on the back of the nail loosens the surrounding particles of the hematoma, and allows the peroxide to penetrate and remove the last particles.

When the hematoma has been completely emptied, the principal part of the operation is over but the subungual cavity remains empty. The surgeon must then be prepared to carry out



Fig. 7. Subungual hematoma, about to be capped. 3, Filling ended. 4, Aesthetic effect.

the primal object which induced him to undertake the operation, that is cosmetic obturation.

#### COSMETIC OBTURATION

After cleaning out the hematoma the cavity is seen through the horny layers of the nail as a translucent whitish area contrasting noticeably with the dark stain following the original injury (Fig. 7). The aesthetic effect is evidently improved, the mark has completely vanished, but the cosmetic ideal is not attained for the trephine openings are noticeable, and the rosy tinge has not been restored to the nail. From the outset, however we hoped to discover some means of obtaining a more ideal and artistic result than that secured by simply voiding the hematoma. To this end we were greatly pleased to enter into collaboration with the chief of the Odontological Section of the Parmenio Pinero Hospital, Dr. Atilio Valencia, who furnished us with interesting data on the subject of dental occlusion, and after several attempts we succeeded in securing the most suitable material for filling up the cavity. The problem to be solved was what kind of paste to use to fill the hole, and at the same time show through the transparency of the nail the natural rosy tint, or at least something sufficiently like it to conceal the injury. Something must be chosen which would fill the cavity for if it was not filled, it would become filled with everything with which it came in constant contact, as dirt, powder and soap. Now this could be accomplished in three ways. First by closing the orifice trephined without filling the cavity and leaving the latter exposed to the air, second, by completely stopping the cavity third, by tucking the nail on its inner surface, and closing orifices.

The first suggestion is not in accord with true cosmetic art, nor does it relieve the unlovely effect alluded to previously as the pale rosy tint of the nail is not restored to the spot injured. Dirt is kept out, however. By the second method, the complete filling of the cavity the desired aesthetic effect is achieved, and the cavity is

kept free of particles of dust. The third method, tinting the nail, is simple and worthy of being studied, but the opening must be closed or organic matter cannot be excluded.

Before entering into the technique of obturation, let us consider the possibility of infection in the cavity to be filled, and the possible consequences, mistakenly and with undue alarm compared to dental fillings. This objection has been made, but has no *raison d'être* because several days after injury the subungual cavity is found to be in the unguis corneous tissue, for the subungual derm proliferates and reproduces corneous tissue underneath the hematoma, therefore isolating it from the organic medium and producing a real intra unguis cavity independent of the organism. Therefore, when the hematoma has been removed the cavity may be filled without any danger of infection. These cavities, of course, cannot be compared with dental cavities, because the dental cavities are in intimate contact with organic tissues, such as the dentine or the alveolo-dental ligament.

#### OBTURATION TECHNIQUE

When the hematoma has been extirpated in the manner described, the cavity must be well dried, and for greater security, washed with serum then with high proof alcohol and lastly dried with an air syringe as used in dentistry. The alcohol which may remain is evaporated, and the air vapor contained in the cavity dried

Dry and warm air is taken up from the flame by the proper syringe such as used by dentists, and expelled into the unguis cavity until the latter is apparently dry. Immediately thereafter the cavity is filled with the paste already prepared, which, to be efficaciously applied, must possess certain properties. As a matter of fact, it must be semi-fluid so as to enter into all the tiny spaces surrounding the cavity. It must be of a rosy tinge deeper than that which is normal to the nail for through them the color is modified. It must solidify in a short time so that the filling may persist and its temperature must not exceed that of the unguis body when applied.

After several tests, we can heartily endorse the use of dressing seal or rose-colored putty. As it dissolves in chloroform we make a paste more or less fluid, at will, according to the quantity of solvent used. The cavity is filled by means of a common syringe which takes up the semi-fluid paste and drives it into the cavity through one of the orifices trephined in the nail. The other opening is left open so that the cement in entering the cavity expels the waste air.

The putty or cement must be pushed slowly in, until the air is wholly expelled that is until it comes out through the opposite unguis orifice. Then, closing the orifice with a tiny rubber piston (Fig. 5) and continuing to press in the paste we raise the pressure within the cavity so that the paste will have to push into all the tiny free spaces.

ETHYLENE OXYGEN ANÆSTHESIA IN OBSTETRICS AND GYNECOLOGY<sup>1</sup>

By A. SPROAT HEAVY, M.D., F.A.C.S., CHICAGO  
Associate Professor of Obstetrics and Gynecology, Rush Medical College

LUCKHARDT and Thompson<sup>1</sup> in 1918 and Luckhardt and Carter<sup>(2)</sup> in 1922 working at the University of Chicago, demonstrated the physiological effects of ethylene and in March 1923<sup>(3)</sup> its use as an anesthetic for surgical work was begun at the Presbyterian Hospital of Chicago. This gas has so many apparent advantages that shortly thereafter its use was adapted to the work in the obstetrical and gynecological department. At first it was secured from Luckhardt's laboratory but it now comes to us from commercial sources and is administered through the same machine as nitrous oxide. While it was still new and in the experimental stage its administration was presided over by the supervising anesthetist of the hospital. It is now administered in the gynecological and obstetrical department by the internist.

For years we have made it a rule not to give any premedication to patients who are to be anesthetized. We have followed the same rule in giving ethylene. It has now been administered

45 recorded times without ether and 70 times with ether in the gynecological operating room 193 times without ether in the obstetrical department and many uncounted times for a few minutes for pelvic examinations in both gynecological and obstetrical conditions. Ethylene cannot be too warmly recommended for diagnostic examinations. Because of nervousness or tenderness, or for other reasons examinations without anesthesia are frequently inadequate. Anesthesia with ether while satisfactory in relaxation requires such a prolonged recovery stage that it is rarely used on bed patient and almost never for diagnostic purposes on ambulatory cases. Under nitrous oxide the patient is frequently not relaxed sufficiently for a diagnosis to be made. Ethylene is entirely satisfactory for this purpose—the relaxation is complete and rapid and the recovery while not quite so dramatic as after nitrous oxide is still quick enough for practical purposes. Complete recovery in 30 minutes is to be anticipated in all cases, most patients being able to leave the examining room within 5 minutes.

It is ideal for making vaginal examination before or during labor in obstetrical cases. Whenever possible a sterile vaginal examination is made a week or more before expected term. We have not

yet encountered a case where the patient could not promptly return home. Ethylene is so satisfactory to the patients that they object subsequently if vaginal examination is attempted without anesthesia and during labor complain of the rectal examinations which the previously unanesthetized rarely find objectionable.

In gynecological work ethylene has been entirely sufficient for even the most extensive operations carried out by the vaginal route such as interposition operations, vaginal hysterectomies, and the extensive repairs necessary for the correction of complete prolapsus. Nitrous oxide and oxygen is usually sufficient for such work without the aid of ether but frequently ether has to be added even when, as occasionally happens, it is for some reason or other highly undesirable. Extensive prolapse operations are frequently necessary among elderly women where the diseases and frailties of their age may contra-indicate ether and may make nitrous oxide undesirable. Formerly we performed operations upon these elderly women under novocain locally administered, but because of the length of time necessary to secure anesthesia, and the prolongation of the operation in order to avoid traction pain we no longer add local anesthesia in these cases. We consider that if they are operated on at all, ethylene is as safe as local anesthesia and the patient will be less fatigued and can be more skillfully operated upon. Our oldest patient in this prolapse series was 70 years of age and the anesthetic gave us not one moment of anxiety.

For extensive pelvic operations by the abdominal route with the patient in Trendelenburg position ethylene and oxygen alone are not always sufficient. Relaxation is sufficient usually if the field of operation is easily entered. When, however, the pelvis is deep and extensive packing away of the intestines is required in order to secure visibility then ether may have to be added. The necessity for this is less if the abdomen is not too quickly entered after apparent narcosis, for though the patient may enter anesthesia quickly relaxation increases as the time of the administration lengthens. We note that as the intussusception increases, he has to resort to ether less and less often. In the cases where ether was added there were no contra-

indications to its use and it was quickly resorted to in order that the operation might proceed without delay. There was not the same attempt among my internes to make the ethylene reach as there was among the professional anesthetists on the surgical side. However in all the cases where it was highly desirable that no ether be given, ethylene proved sufficient.

A patient under management by Dr. Woodruff for diabetes was operated upon for the removal of a large fibroid of the uterus which threatened debilitating bleeding. She was sugar free at the time of the operation and the removal of the uterus was moderately complicated by old infected tubes and fixation of the lower pole. Ethylene with oxygen was sufficient. The patient suffered none as far as her diabetes was concerned and made an uneventful recovery. I never had a patient whose convalescence was so undisturbed by gas pains and sleeplessness.

In 1913 at the Presbyterian Hospital, Chicago nitrous oxide was first used in the regular conduct of labor to secure analgesia during child birth. Shortly thereafter articles were published by J. Clarence Webster (4) Frank W. Lynch (5) and N. Sproat Heaney (6) which described the technique and recommended to the profession this means of lessening the pains of labor. Many others have since contributed to our knowledge and the results in thousands of cases have been published.

In labor we now give as routine, where desired ethylene instead of nitrous oxide. Analgesia is obtained more quickly with ethylene than with nitrous oxide, and where pains are close together the patient is not so much annoyed by the completeness of the excursions between analgesia and full pain appreciation. In several cases where the degree of analgesia left something to be desired or where the resultant confusion was annoying to the patient we administered nitrous oxide with alternate pains and always with the result that ethylene was decided upon as the patient's choice. We have now had several women return to us who previously were delayed under nitrous oxide and who upon trial of ethylene, have much preferred its effect. Probably as a result of the somewhat less evanescent effect of ethylene, we have greater number of patients than under nitrous oxide who fail to remember any pain after 24 hours has elapsed although during labor they may complain much of the incomplete painlessness. Though it is possible to produce complete anesthesia for the final pains with nitrous oxide I personally have preferred when giving nitrous oxide to add ether for the painage

of the child with ethylene, however relaxation and complete anesthesia are so certain that I consider either inadvisable. Though not so rapidly as with nitrous oxide, the patient revives quickly enough to pass comment on her newborn by the time the cord is severed and the dressing applied.

The ethylene is administered in labor cases the same as in nitrous oxide. Susceptibility varies, usually 80 to 90 per cent ethylene is required. We have, however had cases where painlessness was obtained with as low as half ethylene and half oxygen. While with nitrous oxide the average number of respirations to produce analgesia is four with ethylene satisfactory analgesia comes frequently with the second respiration. Confusion is not so common with ethylene as with nitrous oxide though it of course does occur. We have given ethylene as long as 8 hours to a case in labor. It is our impression that after prolonged administration the strength of the pains become somewhat decreased and that we have given small doses of pituitrin somewhat more often with ethylene administration than we do in a similar number of cases with nitrous oxide. However it has no such pronounced effect as does ether upon uterine contractions. The heart tones of the fetus have been uninfluenced and the child upon birth breathes as promptly as after nitrous oxide. During the active administration, the patients have an unnaturally pink color. Investigations as to a possible union of ethylene with the hemoglobin thus far have been negative but Luckhardt suggests that this question should be re-investigated and I believe it should since neither simple vasodilatation nor a supercharge of oxygen could in my mind explain this abnormally pink color. Whatever the action, it is very transient since normal color comes promptly after the cessation of its administration. Blood shed during this time has a peculiar thin consistency and the superficial vessels are abnormally full. Skin punctures bleed unduly during the taking of the anesthesia. No hematoma have been noticed nor has other difficulty arisen from these phenomena.

Si ten simple forceps operations have been done under ethylene with completely satisfactory results. It was administered with oxygen alone in six difficult forceps cases. As a routine, however I have continued to use ether because my anesthetists are internes and ether has allowed me to give my full attention to the operation itself. With a completely trained anesthetist however I would consider ethylene and oxygen fully satisfactory for a complicated forceps operation.

While uterine relaxation and the consequent tendency to hemorrhage is greater than with nitrous oxide, there is the advantage of a complete and rapid anesthesia as well as a rapid recovery from its effects.

I have removed placentae manually under ethylene and have had none of the struggling which usually occurs when this is attempted under nitrous oxide, nor any of the prolonged uterine relaxation so liable under ether.

Though spontaneous labor may be completed under nitrous oxide, none but the simplest repairs can be performed under that anesthetic. As a rule, if extensive sewing is required, ether must be given. Under ethylene and oxygen the most extensive repairs can be brought to completion without the aid of ether. ether at this time is objectionable because of the great liability of atonic uterine hemorrhage. If ether has been considered necessary for a complicated forceps operation, its use may be stopped immediately after the delivery of the child and all the repairs made under ethylene. Dr. Hewitt, Dr. Kanter and myself have done eighteen abdominal operations and one vaginal cesarean under ethylene and oxygen alone. In one case a Porro was done. The advantages of nitrous oxide oxygen anesthesia over ether for cesarean sections are well known. The almost immediate breathing of the child, the lessened shock, decreased vomiting, decreased uterine hemorrhage, lessened gas pains, and the all-the-way-round incomparably better postoperative recovery can only be understood by those who have seen the actual results in their own hands. Ethylene has every advantage that nitrous oxide has for cesarean section. Added to these advantages are the completeness of the anesthesia, the freedom of straining during operation, the decreased necessity for abdominal packs, and the absence of any effect on the blood pressure, all of which are of the utmost importance to the frequently highly jeopardized patient requiring a cesarean section. In addition if the fetus is already in a precarious condition or if the mother is toxic, the anesthetic may be given without cyanosis or jaundice and these are the

two biggest disadvantages of nitrous oxide in cesarean section.

During complete anesthesia from ethylene the breathing is not exaggerated as under ether but is natural or somewhat shallower. In pelvic operations, this does away in large measure with the necessity of packing away the intestines in order to reveal the field of operation. Also, the patient does not sweat, so that even after a prolonged operation the skin is dry.

The explosiveness of ethylene is well known. During a labor recently in spite of every precaution, we had an explosion in the delivery room. When a pain had been finished the anesthetist hooked the face mask over the mixing chamber of the machine to leave it there until the next pain. As the mask touched the mixing chamber there was a terrific report and a flame spurted from the chamber which burned only moderately and was extinguished by blowing, even before the ethylene had been turned off. The glass cover of the chamber was blown to fragments and bits of this caused superficial pin-point bleeding of transitory interest on the anesthetist's arm. Since there was no flame in the room and since it occurred just as the face mask touched the mixing chamber it could only have been static in origin. This would seem disturbing indeed were it not for the fact that, though such an occurrence is unheard of with nitrous oxide, we had the same accident happen under similar circumstances while administering nitrous oxide probably from fumes of ether previously used. All ready physicians have suggested effective measures to prevent in the future this unusual and rare source of danger. And though we shall exercise every precaution we are not at all disturbed by this accident and will continue to give ethylene as heretofore.

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## A NOTE ON 'REEF GRANNY AND SLIP KNOTS

By KENELM H DIGBY F.R.C.S. (Eng.) Honorary, CANTON

IT is curious that the student learning to tie a reef knot should be continually enjoined in elementary textbooks to avoid making a granny while no warning is given him against the much more untrustworthy slip knot (Fig. 1).

The relative merits of these three knots can be tested very simply by tying a piece of string over the blades of a pair of pressure forceps and then trying to open the handles. This subjects the knot to a bursting strain from within the loop of the string similar to the expansive force of arterial pulsation when an artery has been ligatured or to the tearing-apart force when the union of two aponeuroses by interrupted stitches is subjected to strain.

If tightly tied the reef knot does not yield; the granny knot under strong force gives a little way; the slip knot yields readily and continuously to internal pressure.

The granny is only a little less dependable than the reef. Its yielding at all seems to be because the ends are not bent sharply back upon themselves *the same plane*. The weakness is especially to be noticed if the knot is somewhat loose or the ligature material is smooth incompressible and elastic so that it does not bite tightly into itself.

That the slip knot should yield at once and progressively to internal pressure is clear from the diagram.

Although the slip knot is thus shown to be far more dangerous and unreliable than the granny it is surprisingly often used—sometimes unawares—by surgeons. It is produced by pulling tightly on one end of the whole time the knot is being

tied and by failing to cross the ends satisfactorily when each part of the knot is formed (Fig. 2).

Adding in a similar way a third part to the knot does not in any way improve matters. The error is most likely to occur in the quick, showy one-hand methods of tying knots.

The only way to be certain that a reef and not a slip knot shall be tied is (1) to cross the ends in tying each part of the knot so that each end is running in exactly the opposite direction to that in which it was running before, and (2) to relax completely both ends between tightening the first and second parts. The first part of the knot should be relieved from all strain at this point if possible (Fig. 3). (Otherwise a double turn over the so-called surgical knot, would have to be employed.)

So long as these rules are observed the particular choice of one of the many possible methods of tying a reef knot is immaterial from our immediate point of view.

It is said that a conjuror tied up with thick stiff rope secured by a reef knot can release himself rapidly by strongly jerking either free end with his teeth so as to convert the reef knot into a slip knot (see Fig. 1) from which he can escape at once. But in the tissues of the human body there is no force which could so pull on one short end. The reef knot can, therefore, be absolutely relied upon. (If the ends are to be cut very short a third part should of course be added, especially in dealing with plain catgut which is somewhat elastic.)

One may sum up this note by urging that great care be exercised to avoid making a slip knot a substitute for a reef knot.



Fig. Reef granny and slip knots

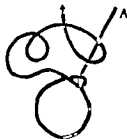


Fig. Tying slip knot

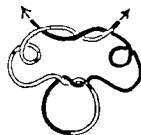


Fig. Tying reef knot

# EDITORIALS

## SURGERY GYNECOLOGY AND OBSTETRICS

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MAY, 1924

### THE FOOTPRINTS OF SURGERY IN IRELAND AND ELSEWHERE

PERIODS of intellectual activity in the world's history mark a simultaneous move forward of all branches of science and art, and then follow epochs of intellectual torpor marked by an absence of individual ambition and a state of general stagnation.

When the Pharaohs were building the Pyramids Egyptian surgeons were treating fractures with success. When Barrie was designing the Houses of Parliament the open air treatment of consumption was advocated and later Lister was revolutionizing surgery. The discovery of anesthetics in Scotland was not far removed from the time that Sir John Fowler and Sir Benjamin Baker after a period of 7 years and with the help of four thousand men completed the building of the Forth Bridge. Primitive medical schools of repute existed in Britain in 161 B.C. for in that year Josias the ninth King of Scotland was sent by his parents to Ireland to be educated among the physicians and surgeons. These were times when culture in Ireland had reached a great height, recognized and acknowledged in far-off lands.

In contrast, if we pass to the sixteenth century we find a decay of science and art. National institutions became mired with corruption. Strife and warfare were the order of the day. It was a period of relapse over the whole world. But if we pass along the road for a century or more, we find a great revival—a period marking the height of individualism in contrast to the present time when medicine and surgery are no longer the work of one man.

In Ireland during this period when it was possible for the activities of an individual to determine the progress of medicine and surgery we had Graves, who published a *System of Clinical Medicine* in 1843. Abraham Colles was president of the College of Surgeons in Ireland in 1802 and the great William Stokes of stethoscope fame was born a few years later. There was a plethora of great medical minds at this time throughout the world. Ireland held a high and honored place supported by such champions as Colles, Graves, Stokes, and Corrigan and later by Butcher and Tufnell.

In the transition from individualism to co-operative work there is much to demolish and much to construct. We still find the profession on the surgical side leaning toward that conservatism which would perpetuate competitive medicine and foster self-sufficiency and content. On the medical side the belief in drugs still holds too much sway. The clamor of the public for prescriptions written in cipher is unabated. The sign of Jupiter heading the prescription is a form of tagcraft which, when coupled with other hieroglyphics suggests modern computation with the mysticism of medieval medicine.

On the road of progress are seen many other footprints. We can see the fresh marks of those who taught the value and dangers of transfusion of blood of those who showed us the wonderful properties of radium and the indications and contra indications for its use, and of those who have aided in bringing obscure abdominal lesions into the daylight by means of X ray photography. The art of surgery has reached its zenith, utopia will be found by the biochemist.

Last but not least are seen the steps of those philosophers who taught—like Sir John Bland-Sutton—that, before all things we should remember that fellow craftsmen ought not to be competitors but comrades of the same honored craft and guild.

The spade work of the last quarter of a century may well prove a preparation for some great future advance. The ground is almost cleared for some far reaching discovery outshining Listerism itself which will lead to the physical betterment of the race and contribute to the restful happiness of mankind.

SIR W. I. DE C. WHITEL

### SUBSTITUTE OPERATIONS FOR ENUCLEATION OF THE EYE

**I**n recent years there has been a revival of consideration of substitutes for enucleation of the eye. The need for different methods of providing satisfactory cosmetic results arises from three different sources. First a small number of persons who are advised to sacrifice an eye prefer to keep the globe if it is not unsightly rather than wear an artificial eye. Second the physical condition of the person particularly if advanced in years may make it desirable to do some minor operation to relieve the condition for which help was sought with less shock than accompanies an enucleation. Third, following the removal of cysts of the orbit tumors of

the optic nerve or of other tissues in the posterior part of the orbit so much contraction of the remaining tissues takes place that an artificial eye cannot be fitted while if the eye can be left in place its bed can be built up by substitution of tissue so that a satisfactory position of the eye is maintained often with good motion.

The number of cases requiring a substitute for enucleation is relatively small and aside from the wishes of the patient (and there are few who object to enucleation when it is indicated) is kept down by the larger factor of safety to the fellow eye that is afforded by enucleation.

Implantation of a foreign substance such as cartilage or glass balls into Tenon's capsule following enucleation gives, in most instances, a very satisfactory cosmetic result with greater safety than any substitute operation can afford. Implantation of substances into the scleral capsule following evisceration gives as a rule, no better cosmetic results than implantation into Tenon's capsule, and the reaction following the operation of evisceration is often prolonged and does not afford the protection against sympathetic ophthalmia that is obtained by enucleation.

The greatest need for substitute operations for enucleation is found in cases of painful glaucoma in aged persons and in cases of orbital growth that does not involve the globe when the eye can be saved by a Kriechlein operation or by a method that approaches the growth without interfering greatly with the musculature within the orbit. For such cases opticociliary neurotomy is a satisfactory procedure and may be safely employed. It should not be employed however if there has been advanced degeneration of the uveal tract, nor in cases where the absence of ocular tumor or massive hemorrhage within the globe cannot be demonstrated. Eyes that



have been blind and painful for years from uveitis with secondary glaucoma are not suitable to save and should be enucleated.

The reason for reconsideration of substitute operations for enucleation does not seem quite clear in view of the splendid cosmetic results that are obtained by enucleation and the greater freedom from danger of any condition arising which would necessitate further operation. The operation of enucleation is

easily done under suitable local anesthesia the time for convalescence is short, and the technique of the operation is very simple compared to the substitute operations. It is to be hoped that this factor will prevent a widespread adoption of substitute operations and that the greatest care will continue to be exercised toward producing the best result with the greatest amount of safety to the patient.

W. L. BEVERIDGE





ARTHUR TRACY CABOT  
1852-1912

# MASTER SURGEONS OF AMERICA

ARTHUR TRACY CABOT

**I**N judging of a man's success and the extent to which he has justified his right to live it is perhaps sound to reckon his performance divided by his heredity and equipment.

The sixty years during which Arthur Cabot lived may be said to cover the period during which surgery rose from barbarism to civilization. During that period came anesthesia, the discovery of the bacterial origin of disease (Pasteur) the antiseptic method of treating wounds (Lister) and the aseptic method in surgery. The possibilities of surgery for good or evil were enormously widened. Never were sound judgment and wide perspective more necessary.

Of sound New England stock, his training was broad and catholic. Harvard College, Harvard Medical School, Massachusetts General Hospital, Vienna, Berlin and London. Physically he was spare lean and wiry, quiet of speech, grave of face, yet with a twinkle in his eye which gave evidence of a sense of humor.

His field of work was at the Children's Hospital in Boston as visiting surgeon from 1881 to 1889 and at the Massachusetts General Hospital as surgeon to outpatients from 1881 to 1886, visiting surgeon from 1886 to 1907. At the latter hospital he became the protégé of Henry J. Bigelow, master surgeon of his time, just then perfecting his epoch-making work on the treatment of stone in the bladder. It thus happened that at Bigelow's retirement his mantle descended upon Arthur Cabot who became an accepted authority on stone both in this country and abroad. At the Children's Hospital he early developed the operation for empyema in children and laid down principles only recently widely understood. Here too he fashioned the posterior wire splint for fractures of the leg, which known as the Cabot splint was one of the American standard splints in the World War, thus holding a place unshaken by thirty years of use—a record suggesting the ability of its maker to see the principles involved. At the Massachusetts General Hospital in his twenty-one years as visiting surgeon he left the stamp of his personality upon the institution as a careful sound and skilful surgeon. When necessary he was bold, steady, almost deliberate cool, almost frigid in emergency. To his young assistants and associates he may have seemed cold, austere, even stern, but his profound reverence for the truth, his gentleness of touch, and his rare but almost electrifying smile will remain as their chief

memory. A tireless worker unsparing of self he had no patience for careless work or hasty conclusion. His gray steady eye pierced sham and reached fundamental truth, a sharp critic, but unprejudiced, even detached when searching for the facts.

Perhaps due to his studies abroad he early saw the essential dependence of modern surgery upon the pathological laboratory. The equipment at the Massachusetts General Hospital for work in pathology and bacteriology was at that time meager and the resources of the hospital were strained. To meet this need and keep the "old hospital" abreast of the time he, together with his brother Samuel, donated a considerable sum of money toward the building up of a hospital laboratory as a memorial to their father Dr. Samuel Cabot.

As a teacher though less brilliant than his predecessor Bigelow or than his colleague M. H. Richardson he was clear, concise, forceful. Never a brilliant speaker he was, however, a most effective one, coming briefly, accurately and relentlessly to the point.

As a writer he was a master of medical style. His choice of words was careful and his style was characterized by short, terse sentences, their meaning compressed into the briefest possible space. Many of his younger associates who submitted their papers to him for review will remember how they would be returned with nearly a quarter of the words cut out, and how he would say with a twinkle in his eye "I think that all the meaning is there."

Few tests of the contemporary estimate of a surgeon are more searching than the opinion of his professional brethren when choosing a surgeon for themselves. They are apt to select the sound rather than the brilliant, the judicial rather than the dexterous. To Arthur Cabot came an unusual number of his professional brethren seeking care for themselves or for their own.

But he was much more than a great surgeon. The judicial quality of his mind, his vision and his breadth of experience led to his appointment in 1896 as a member of the Corporation of Harvard College, that select group of five who largely control the destiny of Harvard University. Those who are familiar with the University during the succeeding fifteen years will recall many evidences of his work in that body. His appointment was not primarily dictated by the need of a physician on a board which must guide the development of a medical school, among other things, for the Corporation already had among its members a physician of broad experience and surpassing wisdom in Henry P. Walcott. Nor can it be regarded as accidental that it was during this period that the Harvard Medical School lost some of its more provincial character and acquired the broader appeal which it has today.

But he was more than a wise counsellor. His knowledge of Art and his keen sense of beauty made him for many years a valued trustee of the Boston Museum of Fine Arts.

Finally in estimation of his performance let it be remembered that he had none of the robust health so commonly found necessary to the successful surgeon. Subject for most of his life to attacks of dyspepsia, frequently to blinding headaches, he worked when prudence and inclination would have dictated bed. If under these conditions he was occasionally short with his younger brethren, it was perhaps a pardonable sin. Judged by any criterion he may be held to have earned the title of Master Surgeon and to have justified his right to live.

HUGH CABOT

# TRANSACTIONS OF SOCIETIES

## CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD FEBRUARY 15 1924 DR. CHARLES S. BACON PRESIDING

Dr. BACON called the attention of the secretary to the recent deaths of two prominent American gynecologists, Dr. Henry Orland Marcy and Dr. Lewis Samuel McTier, and gave a short sketch of their lives and an appreciation of their professional and public services.

### SPECIMEN OF TUBERCULOSIS OF THE CERVIX

Dr. CAREY CULBERTSON. The specimen that I wish to show is one which I secured this morning from a young woman, 21 years of age, negro, who had been delivered at term 3 years ago. She had had one induced abortion  $\frac{1}{2}$  years ago at the third month. Her menstrual history was normal until October 1922, but since that time she had not menstruated. She came into the hospital complaining of pain and soreness in the lower abdomen, present for 3 months, of amenorrhea, and of recent vaginal discharge which was blood stained. The discharge was rather a thick mucus only slightly stained with blood. There had been no free hemorrhage.

On examination the cervix was markedly thickened, increased in size and apparently had been lacerated. On the anterior lip there was an ulcer stamped or punched out and irregular shape. On the vaginal side of the anterior lip there were two spots which looked like small ulcerated areas and the vault on the left side was deep ulceration entirely separated from the others.

The question of differential diagnosis came up. The lesion looked like an early carcinoma, but the patient's age was rather against this. Two weeks ago we removed a small portion from the anterior cervical lip for diagnosis. I might say that above the vaginal vault there was extensive induration and higher up this induration extended into the right pelvic wall so that it was impossible when she was awake to make out the position of the uterus, its size, or its appendages. The microscopic examination showed the characteristic lesions of tuberculosis. At operation today the tuberculous process was limited to the pelvis and the peritoneal surface of the tube above a very definite tuberculous.

Tuberculosis of the cervix, as you know is rare. I have chemical article on pelvic tuberculosis, Williams gathered from the literature 33 cases in which the cervix was involved. Moore, in 1909,

stated that there were about 50 cases of secondary tuberculosis of the cervix and only about 5 or 6 primary cases reported up to that time. The case is secondary inasmuch as there is a tuberculous in the peritoneal cavity. It is of the ulcerative type. The tissues were permeated throughout and quite as friable as in carcinoma, and the induration quite as extensive and hard as that of carcinoma.

### DISCUSSION

Dr. MARK T. GOLDSTONE. Were there physical findings in the lungs?

I would like to question the advisability of doing hysterectomy in this case for evidently the tuberculosis is only a small part. I have always felt that tuberculosis of the ovaries and tubes is a relative contraindication. I would like to hear a little discussion as to whether hysterectomy is indicated in cases of this kind, particularly with ulcers in the vagina and vaginal cul-de-sac.

Dr. J. P. GREENHILL. A few years ago while at the Johns Hopkins Hospital I studied 300 cases of tuberculous salpingitis. In this series both tubes were involved in 97 per cent and tuberculosis of the uterus occurred in nearly 73 per cent of the uteri removed, the disease in most instances being limited to the endometrium. The ovaries were tuberculous in 33 per cent, while the cervix was involved in seven cases and the vagina in one.

Of the seven cases of tuberculosis of the cervix three were associated with tuberculous endometrium and three with tuberculous of both endometrium and myometrium. The fibrous ends were sealed off three times as frequently as they were open.

Regarding the question of sterility I might add that 60 per cent of the patients in the series I reported had been sterile.

Dr. CURTIS. Was this series of 300 cases of genital tuberculosis or cases of tuberculosis of the genitalia associated with peritoneal tuberculosis?

Dr. GREENHILL. My study included all the patients who had tuberculous salpingitis regardless of whatever else they had. Of the 300 cases, 65 per cent had peritoneal tuberculosis.

Dr. GOLDSTONE. What was the end result in your series?

Dr. GREENHILL. Of the 300 patients, 7 died in the hospital. I tried to communicate with the re-

making patients but could obtain information regarding only 90. These operations had extended over a period of 30 years and it was difficult to locate some of the patients. Of the 90 patients 3 died, but the cause of death in 3 had no relation to tuberculosis and of the other 9 who died 7 had had active pulmonary tuberculosis at the time of operation. Nearly all of the 63 living patients had markedly improved after operation and remained well. I might add that radical operation had been performed in 53 per cent of the cases.

Dr. A. H. CUTTS: Were the fibrinated ends of the tube open?

Dr. CARRY CULBERTSON (closing the discussion): As soon as a suspected tuberculous the patient was examined very carefully by an internist and he was unable to make out any lesions in the lungs or in the bones. X-ray of the lungs was negative.

The fibrinated ends of the tubes were closed. In most cases of pelvic peritonitis the patient is sterile. This is the first case of tuberculosis of the tube I have seen in which the patient had borne children. In the majority of cases tuberculosis of the tube is disease of the young adult appearing during the years of adolescence. This young woman had her first baby at 18 when she was just past adolescence. Another feature of the case which is always brought out in discussing etiology is the question of tuberculosis in the husband. In this particular case we are unable to arrive at any conclusion regarding that since there has been no husband.

Where the pelvic tuberculosis is only a part and small part at that of a general peritoneal process I think that there is nothing to be gained by extirpating the pelvic organs. I have seen a number of cases of general abdominal tuberculosis where there was matting of the intestines from the diaphragm down and where it was possible only to drain and evacuate the sacculi. Such is the aim of the dissection, and then to close the abdomen. In some cases this would all not stay closed but it will break open and drain. These have long continued drains and but many patients eventually recover. I operated upon such a case of a woman who was under medical care thereafter for 7 months. She eventually made good recovery and is now earning her own living. Where the tuberculosis process is limited to the pelvis, as it was in this case, the consensus of opinion bears in favor of complete extirpation. In this particular case the ovaries might have been spared but as Dr. Greenhall said in over 50 per cent of cases the ovaries are involved. We know that the uterus was definitely involved before we started to operate and from this assumed that the condition higher up was the same. The same attitude was taken by Webster, who recommended extirpation of the organs in cases of tuberculosis of the tubes even though there was found no definite involvement of the uterus. Moore states that every case of cervical tuberculosis should be treated by radical extirpation.

## ACUTE HÆMOLYSIS

Dr. RUDOLPH HOLMES: I wish to report on the case of acute hæmolytic following delivery. This is the fourth case that I have had the misfortune to see. The other three have been reported.

About fifty years ago Dr. J. V. Fowler called me to see a woman who was having very profuse hæmorrhages. She did not know whether she was pregnant or not. She assumed that having gone over a period she was pregnant and took what she thought was magnesium sulphate. She began to have hæmorrhage about 6 or 7 o'clock the evening. It became profuse and she sent for Dr. Fowler. He could not determine whether she was pregnant or not. He had to go to a neighboring drug store to telephone me and was gone about 5 or 10 minutes. When he came back he could not understand the change which had come over the woman. She had changed color and looked like part-breed India. She was intensely discolored when I arrived about an hour afterward. Indican was present in the urine which was almost black from the hæmoglobinuria. She lived about a week. The hæmorrhage stopped. The hæmoglobin went down to the millio. She died from a concomitant dysentery. She had a pneumococcus infection.

The next case I saw was at the Cook County Hospital. The patient came in suffering from the effects of an abortion apparently though she denied attempts at criminal abortion. However we found later that she had introduced a catheter. The nurse was writing her history when he noticed that she was changing color. From the time he began taking the history she likewise changed to the color of a part-breed India. He examined the urine and it was loaded with hæmoglobin so that it was black in color. She lived about 24 hours after she entered the hospital perhaps 24 to 36 hours after the attempt at self-abortion. She died at midnight Saturday night. The following morning Dr. Finner made the postmortem and there was only one structure that could be identified and that was the uterus. She was like a woman who had been floating in extrem cold water for weeks. She had a Welch bacillus infection and streptococci were found in the blood and in the vaginal secretions. The veins were swollen so enormously that when Dr. Hunter cut it if in them there was geyser of watery fluid released.

The next case was that of a woman whose first postpartum had cut gall stone colic. It lasted 24 to 36 hours. She lived in Texas and was told her that view of the fact that she lived in this out of the way place with the nearest operating surgeon 50 or 60 miles away it would be advisable to have her gall bladder opened to see if there were stones. She went home, however, and her family physician advised against an operation. She became pregnant a second time and I saw her about every month during her pregnancy and frequently asked her if she had had any more attacks of gall-



stone colic. She said she had not. She went through her pregnancy and came up here for confinement. A few days after her arrival here she had a very anomalous thermal reaction, 101 or 102 degrees, then down, and then she would be chilly. She absolutely denied any soreness or pain or discomfort in relation to her gall bladder. Finally she was delivered. The placenta, however, did not come and I partially manually removed it. The blood which came was very watery and very dark. I put in a prophylactic tampon and asked her if she had any pain. She said, Uncle, there has not been one minute since that time that I have not had that gall bladder soreness. Many times I stuffed the sheet in my mouth so my husband would not hear my groaning. I was afraid to disturb any one and I would not even tell you. She was delivered about 3 and about 1 o'clock I went in to say good bye to her and pack up the uterus. I removed the tampon and there was little blood dark and watery. I gave her some ergot. In a little while I took her upstairs. She had been in a darkened room and in the bright unlighted operating room I saw that her skin was discolored and that the urine was discolored. She had one little stitch drip. The blood from this was very dark. She lived until 3 o'clock and died.

Early in November 1913, I delivered young woman, 3 years of age. The first days of October she called me up and then came in account of soreness in the epigastrium, not particularly referable to the gall bladder. There was no tenderness on pressure but she was uncomfortable and did not feel normal. Her bowels and urine were normal. She never had such a cute distress after that but once in a while she said she felt a little soreness. I examined about four or five specimens during that month and they were negative, but I could not quite tell whether there was a cloud or not, the reaction to albumin was so extremely faint. Her blood pressure was 110 systolic and 60 to 70 diastolic. She went on to term. Labor started on Friday afternoon 1 o'clock with rupture of the membranes. She came to the hospital about 7 or 8 hours later having had no pain. During the night and the next morning she had an occasional cramping. About 6 o'clock Saturday night she started in active labor. About 9 o'clock she had been fully dilated with the head on the perineum and I terminated labor with low essay forceps. The placenta did not come and we began to see the drip, drip of watery blood. I did a Credé and the placenta came without any untoward difficulty and with about 3 or 4 ounces of this same blood. Being suspicious of that peculiar dark blood, I put in a prophylactic uterovaginal tampon. We got her back to bed about 10 o'clock. About 11 o'clock I saw her and she had a pulse of 160 or 170. The genitals were red and you would say she had lost no blood. Unfortunately I had an urgent call and went away. I came back in three quarters of an hour and she was dead. Just after I left the nurse recorded on the history sheet that she

had very suddenly become cyanosed as she thought. She was in the operating room and with the sea streaming in, her color as that of a half breed Indian—the genitalia and skin everywhere from head to foot. I wondered what could be responsible for the hemolysis, could she have had a rupture of the uterus that I had not recognized, from the fact that her pulse went up so rapidly without other signs. I removed the uterovaginal tampon and made revision of the uterus. It was intact. When I removed the gauze about 3 or 4 ounces of this same watery blood came away. When I removed my hand about 2 or 3 ounces of this same blood came away. She had been dead about 30 minutes then. While I was away from the hospital they had grouped her for blood transfusion and she was in Class 3. The int. rube. made the grouping and he never saw any blood like it. It was just like water. There was no tendency to coagulation. The question was if she had lived long enough to have taken the donor's blood would it have done any good? Would whatever I was have produced this acute hemolysis with the donor's blood or would the substance which was producing the hemolysis immediately have attacked the donor's blood. I have not investigated it. Being unfortunately friend of mine I did not have the heart to say postmortem to the family.

This is a rare thing. I have asked various people if they would have transfused. No one knows.

DR. N. S. HEAVY: What was the diagnosis? One case was due to the streptococcus, another to pneumococcus, what was the last one due to?

DR. RUDOLPH HOLMES (closing the discussion): The diagnosis was acute hemolysis. There was no bacteriological exam. when made in the last case, it was probably a bacteremia.

#### ETHYLENE GAS IN GYNECOLOGY AND OBSTETRICS

DR. N. SPROUT HEAVY presented paper on the use of ethylene gas in gynecology and obstetrics (See p. 69.)

DR. CARRY CULBERTSON: To me one of the most interesting things in the discovery of ethylene gas as an anesthetic is the fact that it was based upon pure academic research. It is one of the results that has come out of the work of Lockhardt on laboratory animals and experiments. It arose from a desire to ascertain what toxic effects ethylene, one of the constituents of ordinary illuminating gas, would have upon animals. Lockhardt and his associates were led to this in order to ascertain why roses and carnations brought into the city from greenhouses died as soon as they were put into storage. The results of the experiments showed that, far from having a toxic effect on animals, the ethylene gas had almost the opposite effect, producing changes in the blood similar to those due to ethyl alcohol. The tests in some of these cases showed that there is tendency to coagulation at the time the gas is given or afterward.

As for the use of the gas in surgical work, the advantages are those brought out by Dr. Heaney: a better state of relaxation, lack of cyanosis, better breathing and none of the disturbances we get with nitrous oxide. I have found that I can start dilatation of the cervix in less than 60 seconds after the administration of the gas is begun. This cannot be done with nitrous oxide and, of course, not with ether. For a prolonged operation, such as vaginal work combined with abdominal section, the gas is continued and the operation proceeds just the same as if the patient had been under straight ether anesthetic. I think it is an advantage, as has been stated, particularly where the anesthetist is inexperienced, as our internes are to administer some ether just prior to abdominal section so that there is not only a further degree of relaxation but a more prolonged one until the intestines are packed off. Then after the pelvis is exposed the ether can be entirely withdrawn and the operation carried on under gas and the closure made under gas and oxygen alone.

When we first began using ethylene gas in normal labor we found that the patients were inclined to quit the pains would become less frequent and perhaps not quite so strong. We soon discovered that this was due to the fact that the internes, having been used to giving nitrous oxide, were giving ethylene in about the same proportions and giving too much of it. There is no question but that under the care of an experienced anesthetist ethylene gas has proved to be extremely helpful in all surgical operations. In the upper abdomen the relaxation is not quite so good and there I think more ether will have to be used in association with the gas.

Dr. R. A. SCOTT: I understood the doctor to say that during the administration of ethylene there was increased bleeding. Was that a chemical or physiological change? Was there increase in the blood pressure and as the bleeding due to the rise in blood pressure?

Dr. W. F. HEWITT: In using ethylene I have made the following observations. I believe nitrous oxide is better first stage anesthetic than ethylene unless we have a tendency toward spasm of the cervix. Then, perhaps, neither anesthetic is advisable but if one is used ethylene is preferable. Ethylene is better for the second stage than nitrous oxide. We do not notice any change in the amount of bleeding following the second and third stages. We noticed in cesarean section that the breath of the child was very strongly suggestive of ethylene odor but did not notice any change in the onset of expiration. In cases of patients who had nitrous oxide before and ethylene later my experience has been that the patients are in favor of nitrous oxide. One of my cases was perhaps among the first in Chicago to get ethylene, even before it was used at the Proby-Tennant Hospital. There was one child who had a spontaneous hemorrhage with no evidence of trauma to explain the hemorrhage and was born without cyanosis. That is the only case in which I

found any evidence of bleeding on the part of the fetus. It was not traumatic.

Dr. A. H. CURTIS: In our service at St. Luke we have used ethylene in a series somewhat larger than that of Dr. Heaney' but over a shorter period of time. Dr. Watkins, Dr. Jones, and I have had a somewhat similar impression concerning its value. We like it very much in plastic work but have not been able to obtain as early relaxation as Dr. Heaney. In abdominal work we are gradually drifting back to greater amount of ether or ether with ethylene. It would seem that in gynecological work in contrast to general surgical abdominal work, ethylene has a somewhat limited field.

Dr. BERTHA VAN HOOZEN: I am very much interested in the report on the new anesthetic but I was a little disappointed that they had not used any preliminary hypodermic injections with the ethylene. When ethylene came along I was very anxious to try it and since last November we have used it as an adjuvant to scopolamine and morphine anesthesia. It produces perfect relaxation, though I do not know how much relaxation there would be if it were used without a preliminary narcotic. There seems to be much less tendency to postoperative vomiting. I have had very limited experience but I am glad to report that so far it seems to me that ethylene is the anesthetic I have been looking for for years and I am very grateful to have found it out.

Dr. RUPOLD HOLMES: May I ask the relative cost of ethylene and nitrous oxide?

Relative to the explosive properties of ethylene I might cite an instance that occurred at the naval station at Annapolis some years ago. One of the officers on cold dry night went to the garage to get his car. He was wearing a fur coat. As he attempted to put some gas in the car the engine blew up. That was static from his fur coat. The explosion from ethylene may also be static.

Dr. N. S. HEANEY (closing the discussion): Luckhardt and others have tried to find out whether there is a union of the ethylene with the hemoglobin to account for this peculiar color and increased bleeding but as I stated in the paper so far they have found nothing chemical to account for it. I have noticed this particularly in abdominal work. As soon as you begin to cut you find a good many more capillaries bleeding than with nitrous oxide or ether. It is however transitory and while somewhat bothersome in the first operations you do under ethylene you soon get used to it. It does not cause the patient any trouble.

Ethylene was very much cheaper than nitrous oxide when we first began to use it. At that time it was a commercial product. As soon as it became a medical product the price was increased. At the present time the price of nitrous oxide and ethylene is the same. It costs about one-half to one-third as much as nitrous oxide for obstetrical cases because you use very much less of it.

We believe that the reports of ethylene and oxygen as an anesthetic are very much more valuable for

your evaluation if we do not use any preliminary medication, so that you can judge the effects of the actual anæsthetic employed. Dr Allen believes that the patients are losing a little more blood when they are getting ethylene than when they are getting nitrous oxide. I thought that the pains became less strong more quickly with ethylene than with nitrous oxide. Earlier I gave them alternate whiffs of nitrous oxide and ethylene but you see that would not be very valuable as deciding factor because the ethylene would hang over to the nitrous oxide.

**Administration and reverse.** For the last weeks we have conducted several cases by giving nitrous oxide for 5 minutes and ethylene for 5 minutes counting the frequency of the pains and the duration of the pains to see whether there was any difference. The tally was practically the same. I believe there is freer bleeding after delivery with ethylene than with nitrous oxide. That may be due to the peculiar consistency of the blood. If you give a hypodermic during the administration of ethylene there is a pink streak on withdrawing the needle. During operation the blood seems to coagulate just as quickly as with nitrous oxide. Last night I had a patient who was delivered with low forceps. We had a repair of an epiotomy to do. The patient had fatigue of the uterus and probably would have had some hemorrhage in the absence of an anæsthetic. We gave her ethylene and she went promptly to sleep but began bleeding too much. We stopped the anæsthetic and the bleeding stopped but recurred as soon as the anæsthetic was readministered. There could be no doubt at all that uterine relaxation as produced by the ethylene. However with nitrous oxide under such circumstances we could not have done the repairing and ether would no doubt have increased the amount of blood loss. We feel quite certain that ethylene is quite satisfactory both obstetrics and gynecology. While we do not wish to say that it is going to replace nitrous oxide entirely.

I believe that the rôle of nitrous oxide has been greatly diminished by the discovery of ethylene as an anæsthetic.

**DR VAN HOOSEN:** Can errors be done?

**DR HEANEY:** I had occasion three nights ago to attempt forceps operation on a patient we had under ethylene. It was a child with an unusually soft head. Occiput right posterior with complete dilatation. I made several attempts to turn the head so as to apply the forceps and it was the only time I was not able to do so. The cervix was in front of the head so that I had some obstruction to delivery. I then inserted my hand and felt that the cord was not pulsating very strongly. I was of the opinion that version could not be completed with ethylene gas so we gave ether for the version which terminated fortunately.

**DR CULBERTSON:** I did version under ethylene recently in a head presentation and it was very easy.

**DR BACON:** Will you tell us the cause of the explosion?

**DR HEANEY:** It was about 3 o'clock in the afternoon and there were no sterilisers burning. Dr Allen was giving the ethylene gas. It was a prolonged anæsthetic. After pain he hooked the mask over the mixing chamber (where you put the ether in) and immediately there was an explosion. His arm was covered with multiple minute bleeding spots, none of them deep. In the absence of an actual source of fire it must be considered that the case was static, although there were no other evidences of static power about that day.

**DR DAVENPORT:** Do you find that the ordinary gas machine can be used for the administration of ethylene?

**DR HEANEY:** We use the McKesson machine. In order to do away with the static spark they have placed a wire in the mixing chamber attached to ground wire. We had the same thing happen a year or so ago when we were using nitrous oxide. We use ether in these machines frequently. Probably there was some ether vapor in the mixing chamber. In that instance the explosion occurred in the same way. There is no more danger with ethylene than there is with nitrous oxide and ether as far as our experience goes.





# THE SURGEON'S LIBRARY

## OLD MASTERPIECES IN SURGERY

B ALFRED J BROWN M.D. F.A.C.S. CHICAGO

### THE TEN BOOKS OF SURGERY BY AMBROISE PARÉ

THE name of Ambroise Paré brings to the mind of the surgeon a vision of the enormous amount that can be accomplished in one life time. It seems that looking backward, modern surgery began in Paré yet he himself discovered nothing new, but the adaptation and application of previously known and almost forgotten surgical procedures made him the greatest surgeon of his time.

Paré was an anatomically trained surgeon, and naturally looked at surgical matters from that viewpoint. His first publication of importance was in 1545 when he called attention to the necessity of placing the patient in the same position which he was when wounded in order to extract a burned projectile. By this means he had succeeded in removing a bullet from the shoulder of Monsieur d. Brissac after many futile attempts had been made by others, and the method was considered worthy of publication. In 1553 this book on wounds made by Arques was republished.

The prevailing method of control of hemorrhage in vogue after amputations was the use of boiling oil on the stump of the extremity. This method apparently did not appeal to Paré and, after a study of previous authors whom he cites, in 1555 he amputated a leg and used the ligature instead of the hot iron and boiling oil to check the hemorrhage. He then used the method continuously and in 1564 published it for the first time in his *Deux Livres de la Chirurgie* (Ten Books of Surgery). The condemnation of the cauterization of boiling oil and the advocacy of the ligature in their stead roused a storm of protest which culminated in the publication of a book by Etienne Gourmelen in 1580. Five years later Paré answered this criticism in his *Apologie* in which he gives references to the former surgeons to show that the method he advocated was not new or revolutionary and throughout with the greatest good humor he refers to his adversary Gourmelen, as *mon petit maître* (my little master).

The ten books of surgery, his first surgical work of magnitude, deals with traumatic conditions for the first seven books, while as would be expected from an army surgeon, the last three books deal with genitourinary diseases.

The treatment of wounds shows great advance over other writers of the time. Paré advises the

extraction of the projectile and of any other foreign bodies present. The instruments required closely resemble the present day forceps so far as the blades are concerned, and he shows many types for different shaped foreign bodies. He then instituted drainage for which he used perforated tubes. The first dressing consisted in an ointment injected into the depths of the wound if it be deep. Boiling oil which had been the accepted dressing up to that time he does not advise as he considers it harmful as well as painful. The inefficiency of boiling oil he discovered during his first campaign when for lack of oil he used a mixture of oil of roses, yolks of eggs and turpentine and found the wounds much clearer than with the oil treatment. A modification of this mixture he advocates for the second and subsequent dressings when he adds the yolks of eggs and saffron to the ointment.

The succeeding books deal with the treatment of wounds made with arrows, lances, etc. fractures, contusions, burns, bone caries, gangrene, gonorrhea and burning urination, kidney and bladder stones, and suppression of urine. Above all other things Paré is best known generally for the ligation of vessels after amputation. This he describes in the book on gangrene and the description is clear and concise. He uses a tourniquet and after removal of the limb allows some blood to escape. The vessels are then grasped with a clamp and drawn down and ligated. He particularly warns against including structures other than vessels in the ligature.

Paré as essentially an operating surgeon, a very close observer and a most careful technician. He had great respect for tissues and constantly warns against roughness of manipulation, not only because it caused pain, but also because it militated against the proper healing of the wound. As an example he particularly states that the ends of the forceps to be used for the extraction of foreign bodies must be perfectly smooth and polished lest they injure the tissues of the depths of the wound.

The prevalence of infection which called forth the frequent employment of the newly devised operation of amputation naturally resulted in a large number of cripples. Paré immediately threw himself into the task of designing prosthetic appliances to restore these unfortunates to part usefulness, at least. The results of his labor are illustrated in his book, or considering the engineering and mechanical opportunities of the time remarkable for their ingenuity.

## REVIEWS OF NEW BOOKS IN SURGERY

THERE seems to have been quite an impetus given to the study of the diseases of the rectum and colon in the recent past. This is no doubt due to the fact as mentioned in previous review that the subject has been so long in a chaotic state. One might even go so far as to state that the truly scientific man scoffed at practically all the works, with few exceptions on the subject. One must of course except the works of T. H. and others in this state of the art. For a long period of time the name of a rectal surgeon was odious to most scientific men. It is therefore most pleasing to have presented a volume which bears all the markings of having been prepared by a student scholar and scientist.

It is a great pleasure to read Mummery's *Diseases of the Colon and Rectum*. He takes up the more or less puzzling subject and handles it in such a manner that it is not only most enlightening to the reader but most fascinating. One can say truthfully that the book offers great pleasure and entertainment. The author is very familiar with his subject and he has had a most extensive experience.

In his preface Mummery states that he is giving only his own opinion on this subject. This to the reviewer's mind is a most satisfactory solution of such a problem. There is scarcely a chapter in this admirable work which does not deserve special mention nevertheless the chapters dealing with tuberculosis of the bowel and colitis are outstanding. Tuberculosis of the colon is discussed in its various phases, and the different types clearly pictured. Diverticulitis as well as fistula and hemorrhoids are also handled in a very unusual way.

Several general fundamental principles are emphasized which represent advances: rectal surgery. First, it is possible to do clean work about the anus. The average surgeon fails to realize that fair state of cleanliness can be procured about the rectum and anus. The fact is accepted that these parts cannot be bacteriologically sterilized nevertheless there is no question but what there has developed more or less of an immunity to the ever present colon bacillus group, and if the part is cleaned in the manner outlined by the author fewer failures will be encountered in this line of work. Another most pleasing comment made by the author is marked verbatim the use of so called slops as food for patients to be operated upon and those who have been operated on.

It might be called attention to a possible error on page 7 in formula for local anesthetic preparation, the author states that 5 minims of a 1000 adrenalin solution is to be added to each cubic centimeter of solution. This would give solution of third adrenal. The second error is on page 85 where he mentions douching the rectum

with a solution consisting of 1 drachm of 1 to 1 pint of water. These two apparent errors may be correct, nevertheless to the reviewer's mind they will undoubtedly be questioned by many men, due to the fact that the solutions could carry with them at least potential dangers.

This volume stands as masterpiece in the English language today on the subject which it covers.

AS an associated work on the above mentioned subject, we have at hand contributions which deal with the opinions of sundry men. There is no question but that under certain conditions it is most desirable to have the opinions of many men rather than the opinion of one. On this theory is based modern consultation, and the experienced physician realizes full well that each man consultant as a rule brings a new idea, and rare is the occasion when all the consultants agree. This does not minimize the fact that each man's opinion may open up a new venue of thought, and that each man may have seen in his experience certain phenomena which may have a distinct bearing upon any individual case.

Much credit is due to Pennington for his untiring efforts and the tremendous task which is common to all in his *Diseases and Injuries of the Rectum, Anus and Proctocolon*. There seem to be two outstanding facts which make this volume desirable: first, the most interesting historic sketches which preface most of his subject matter and second the extensive reference to literature and an excellent tabulated bibliography.

With this volume it is comparatively easy to assemble most of the "old" literature on the subject of any disease pertaining to the rectum and colon, therefore relieving one of an enormous task when it is desirable to get a more or less complete discussion on the subject. There is some question.

Neither the frequent and common reference to the findings of many men does not complicate lucidity in the description. This appeared rather striking to the reviewer in many instances. When the symptoms of certain diseases are discussed, to the reader more or less familiar with the subject it is probably interesting and instructive to hear what other men have to say and what unusual symptoms they may have encountered. But to the student who is not familiar with the condition such discussion becomes confusing and he will receive the impression that any symptom may be encountered in any pathological lesion. It would appear therefore, that this work will find its greatest usefulness in the hands of the experienced surgeon and proctologist.

From the standpoint of pure medical honesty and in most sincere effort to combat and destroy that

one impression of the medical profession, the following constructive criticism would be offered that those cases which are enumerated by the author in which the patient has complained of a complete symptomatology far removed, so far as the logical mind is concerned from any disease of the rectum and which are apparently cured by some operative procedure about the rectum be eliminated from the text. This criticism may be unjust and probably is, but it is given with an honest purpose of trying to forget the very odious pest. Such terms as torpid liver very familiar to the old time practitioner yet which has no pathological basis, stamps work as unscientific, and yet with such an accumulation of scientific facts the incompatibility is very apparent. It is interesting to the reviewer to compare this work with the one just reviewed, inasmuch as each has advantages. Altmeyer's very clear concise logical, and most interesting descriptions are a contrast to Pennington's most painstaking accumulation of the world's observations and personal experiences. It seems that each has its place and each author is to be congratulated.

WITH the very rapid strides that are being made in scientific medicine, the average practitioner is fairly deluged with literature. It seems an impossibility to read everything that is written or even to read that which more or less loosely connected with one own specialty. Because there is such an intimate association between the individual's systems and organs of the body and the causes of diseases of various organs the scientific man must keep abreast with not only clinical phenomena which are described, but with research work, and with those advances made in the basic sciences. So much of this work has fundamental basis that one's place one feels securely upon solid foundation it becomes almost necessary to revert back from time to time to the dynamic processes which apparently have no clinical significance. Upon which is laid the basis of sound scientific thinking.

It is with considerable interest that the thirteenth edition of the work of Green on pathology and morbid anatomy, as revised. This manual of pathology and morbid anatomy goes far beyond description of simple pathological changes as exemplified in the chapter on protein intoxication. Just at the present time when the subject of cause foreign protein poisoning and split protein intoxication are before the medical profession their clinical application, it is decidedly interesting to be informed in the more complex reactions and theories regarding this most interesting subject. Cell nutrition, the life cycle of cell and many other problems have distinct bearing on the present time on clinical medicine. As become more familiar with the intricate physiology and anatomy of the cell it appears that many complex problems might be cleared.

This little work carries many evidences of the handwork of a master. Probably many of us will go to a more comprehensive description of pathological conditions, but this volume sets forth in rather clear way the importance of basic changes, be they proliferative or degenerative. Pathological changes in whatever organ are so correlated that their pathological significance is easily grasped.

THE diagnosis of intra abdominal diseases is the most puzzling to many men and yet there is probably no other field which offers a better opportunity of making a correct diagnosis. If one is but familiar with the manifestations of the various diseases affecting the abdominal organs and will take the pains to procure a correct history, which will detail the various symptoms checked up against a careful physical examination and a close observation of the patient, the percentage of incorrect diagnoses should be comparatively small.

Probably in no other field of medicine is a correct history more valuable as this comprises fully 80 per cent of the data in making diagnosis correctly. Many diagnoses of acute surgical abdomen are made and one is content with this diagnosis. Yet with little more time diligence and zeal it is surprising how few correct anatomical diagnoses can be made. The outstanding examples are such conditions as perforated ulcer, acute pancreatitis, abscess of the gall bladder and ducts as distinguished from simple cholecystitis, abscess of the liver and sundry other conditions.

The author of this volume will find a valuable aid in the little work by Adams on cut abdominal diseases. With an correct training in the methods of procuring a correct history and the methods of making thorough physical examination, along with few laboratory tests, the average clinician can in many instances make correct diagnosis. It is the reviewer's opinion that most of the errors are made in making the diagnosis first and procuring the history and making the examination afterward, the effort being made mostly in the direction of confirming the original diagnosis. This is a very serious error and accounts for the large number of mistaken diagnoses. The untrained man must, of course, be schooled in the manifestations of disease processes. It must be taught the symptoms of perforated ulcer of approach of peritonitis. He must be taught the significance of vomiting. He must be taught to analyze paracentesis as character and location. This schooling he can receive from didactic teaching from clinics or from reading.

Unfortunately, only too frequently the student does not appreciate the value of this training until he has encountered the actual condition. For this purpose the above mentioned one is most desirable. The author brings out many points of significance in examination. If goes as a most interesting



description of intestinal obstruction and diseases of the pancreas. It is worth the while of any medical man to go over the subject as presented by the author as it is pregnant with facts which stand out clearly and have decisive value in the diagnosis of these conditions.

ON certain occasions small volumes or monographs appear which have been written by men of ripe experience with the faculty of presenting a subject in such a manner that although the knowledge imparted is most profound, the books read as lightly as an enjoyable novel. These books are most acceptable to the average medical man, because they not only afford relaxation but instill certain inherent principles which are most uplifting and satisfying.

There is at hand at present such a little volume by *Dean* and *Reimann*. It consists of a series of five lectures delivered by the senior author at the Washington University at Seattle. We all know the enthusiasm of this man. We are also fairly familiar with the very definite attitude he has taken on the subject of gastric ulcer and it is most pleasing to have his opinion as a permanent record. It could seem that the present trend in the study of the physiology of the stomach could not substantiate some of the favorite theories of the author. Nevertheless up to the present time there has been nothing to supplant the more or less radical surgery which is devised. Sleeve resection has probably had its day and it is quite apparent that instead subtotal resection will be resorted to more in the near future. Little comment can be made from a scientific standpoint on his discussion of jaundice and diseases of the bile passages, except that the statements are concise and lucid and in every way characteristic of the work of the author. The other lectures are beautifully written from a standpoint of medical philosophy. It is very important that the medical profession pause a moment to acquiesce itself in the boldness of purpose by looking over the works of the past masters. All the lectures bespeak that peculiar mellowness of judgment which comes only from long experience and very mature thinking and it is a great pleasure to read and to read the book with the pure beauty which it portrays. It would be a great blessing to the medical profession if more of our masters could devote even short time to preparing such articles, not necessarily because of the amount of knowledge given as a concrete thing, but the enthusiasm which they bring to the younger men. This enthusiasm is imparted by a great deal which can come only to those men by virtue of industry, self denial and love of their work.

ANESTHESIA is becoming more and more matter of concern to the surgeon. At the present time there seems to be a decided tendency toward the use of local as preference to general anesthesia.

This can be accounted for very readily on the basis of the unusual and unwarranted fatalities accompanying general anesthesia. Up to recent years the teaching of anesthesia was practically nil. A student was graduated in medicine and entered upon an internship absolutely unfamiliar with the art of anesthesia or with practically little knowledge of the potential danger of such drugs as chloroform, ether, and nitrous oxide. Even at the present day there is very little interest manifested in the teaching of anesthesia.

It is reasonable to assume that in the past more than at present many accidents may have occurred which could have been prevented had these students been taught not the details of anesthesia at least the dangers which are possible. There are many works which deal with anesthesia. Their chief objection is that they are long treatises far beyond the conception of the average medical student or intern. The student loses interest and consequently the book is not read.

It is therefore desirable to have a small compact which would analyze the subject briefly and accurately and present those facts to the student which are important. This purpose is adequately and beautifully accomplished in a little work by *Ross*. There was great deal of pleasure afforded the reviewer in reading this little book. It seems to absolutely satisfy its purpose. Chloroform anesthesia is described in the manner in which it should be described as always carrying a potential danger which cannot under any conditions be removed, and the reader is cautioned that such is the case. The author further attempts to give description of local anesthesia and it is the reviewer's opinion that he has detracted somewhat from the value of the book by trying to include this subject. Local anesthesia is so far removed from general anesthesia that it should not be considered at the same time or in the same light. Local anesthesia is a surgical process and involves factors and principles entirely different from those of general anesthesia. This little work is very heartily recommended to the student and to the intern who is required to administer general anesthesia, and if he will but follow its precepts he will avoid much anxiety and criticism.

JOHN A. WOLFE

THE clinical application of the Roentgen ray has effected a revolution in the diagnosis of diseases of the chest. *Clinical Roentgenology of Diseases of the Chest* supplies the need of an adequate treatise on the subject. Nothing comparable to it has been published in English. It should be as valuable to the clinician as to the roentgenologist since not only the roentgen features of thoracic disease but also their correlation to the clinical facts necessary

to roentgen interpretation are discussed. The necessity of such correlation is emphasized.

The book is divided into ten sections which treat of the normal lung, the pulmonary vessels and circulation, the trachea and bronchi, the lungs, the pleura, the mediastinum, the intrathoracic lymph nodes, the diaphragm, surgical diseases of the chest, and diseases and abnormalities of the chest wall.

There is admirable balance between description and illustration. The descriptive matter is lucid, concise and made easy to read by the use of large type. The reproductions of roentgenograms are remarkably good, abundant, and well chosen. The pathological conditions presented are clearly described and, in some cases, explained by diagrams.

W. H. NADLER

## BOOKS RECEIVED

Books received are acknowledged in this department and such acknowledgment must be regarded as sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

**SURGICAL ENTOMOLOGIES.** By Russell Howard, C.B.E. F.R.C.S. New York: Longmans, Green & Co. 924.

**TRANSACTIONS OF THE AMERICAN GYNECOLOGICAL SOCIETY.** Vol. XLII, 1933. Edited by Arthur H. Curtis, M.D. Philadelphia: W.B. Saunders, 923.

**THE NEW SCIENCE OF RADIATION PHYSIOLOGY IN ITS RELATION TO REGENERATION.** Based on the Radiation Technique of Dr. Eugen Stenach of Vienna. By Herman Rubin, M.D. New York: Medical Science Publishing Company, 925.

**BIOLOGIE UND PATHOLOGIE DES WEIBES.** Ein Handbuch der Frauenheilkunde und Geburtshilfe. Edited by Josef Halban, Wien, and Ludwig Seitz, Frankfurt. VI. No. 3—PHYSIOLOGISCHE HORMONKUNDE, by Oskar D. von Eitel, H. Gellermann, Frankfurt. M. BAISER UND WUNDERLICH, 6. IN DER GYNEKOLOGIE, by Dr. A. Langer, Berlin. PSYCHOTERAPIE, by Prof. Dr. M. Wolff, Zurich. Berlin: Urban & Schwarzenberg, 924.

**HYPNIA AND ITS RADICAL CURE.** By J. Hutchinson, F.R.C.S. (Eng.). London: Henry Frowde and Hodder & Stoughton, 923.

**HEMORRHOIDS: THEIR ETIOLOGY, PROPHYLAXIS, AND TREATMENT BY MEANS OF INJECTIONS.** By Arthur S. Morley, F.R.C.S. (Eng.). London: Henry Frowde and Hodder & Stoughton, 1911.

**OPERATIVE SURGERY COVERING OPERATIVE TECHNIQUE INVOLVED IN OPERATIONS OF GENERAL AND SPECIAL SURGERY.** Vol. XI. By Warren Stone Buckhams, M.D. Philadelphia and London: W.B. Saunders Company, 924.

**THE REPRODUCTIVE FUNCTION OF THE P. VULGARIS AND THE SCIENTIFIC ISOLATION OF THE ANTIDIARRHOIC HORMONE—INULIN.** Series 80. By J. J. R. Macleod and F. G. Banting. St. Louis: C.V. Mosby Company, 924.

**METHODS IN MEDICINE: THE MAN AT THE MEDICAL SERVICE OF GEORGE DOCK, M.D. Sc.D.** By George Hethcote, M.D. Ph.D. St. Louis: C.V. Mosby Company, 1924.

**INTERNATIONAL CLINIC.** Vol. Edited by Henry W. Cattel, A.M. M.D. Philadelphia and London: J.B. Lippincott Company, 924.

**APPLIED PATHOLOGY IN DISEASES: THE NOSE, THROAT AND EAR.** By Joseph C. Beck, M.D. F.A.C.S. St. Louis: C.V. Mosby Company, 923.

**RADIUM REPORT OF THE MEMORIAL HOSPITAL, NEW YORK.** Vol. 93. New York: Paul B. Hoeber Inc., 924.

**GOITRE: CONTRIBUTION TO THE STUDY OF THE PATHOLOGY AND TREATMENT OF THE DISEASE OF THE THYROID GLAND.** By Professor F. de Quervain. Translated from the French by J. Snowman, M.D. M.R.C.P. New York: William Wood and Company, 924.

**PERSONAL HYGIENE, THE RULES FOR RIGHT LIVING.** By Allen J. McLaughlin, M.D., assisted by James A. Tobey, M.D. F.A.P.H.A. London and New York: Funk and Wagnalls Company, 924.

**COMMUNITY HEALTH: HOW TO OBTAIN AND PRESERVE IT.** By Donald B. Armstrong, M.D. Sc.D. New York and London: Funk and Wagnalls Company, 924.

**MIAM AND THE MICROBE: HOW COMMUNICABLE DISEASES ARE CONTROLLED.** By C. E. A. Winslow, Dr. P.H. New York and London: Funk and Wagnalls Company, 924.

**THE BABY'S HEALTH.** By Richard A. Bolt, M.D. New York and London: Funk and Wagnalls Company, 924.

**CANCER: NATURE, DIAGNOSIS, AND CURE.** By Francis Carter Wood, M.D. New York and London: Funk and Wagnalls Company, 923.

**A TEXT BOOK OF THE SURGICAL DIAPHRAGM.** By A. J. Walton, M.D. M.B., B.Sc. (Lond.) F.R.C.S. (Eng.). London: Edward Arnold and Company, 923. New York: Longmans, Green and Company, 923.

**TEACHER'S DIETETIC GUIDE.** By Abela Frances Patten Mount Vernon: A. F. Patten, 923.

**PRACTICAL DISTINCTIONS WITH REFERENCE TO DIET IN HEALTH AND DISEASE.** By Abela Frances Patten Mount Vernon: A. F. Patten, 923.

**BIOLOGIE UND PATHOLOGIE DES WEIBES.** Ein Handbuch der Frauenheilkunde und Geburtshilfe. Edited by Josef Halban, Wien, and Ludwig Seitz, Frankfurt. VI. No. 6—PHYSIOLOGIE DER WEIBLICHEN GENITALORGANE, by Prof. Dr. L. Frenkel, Bremen. BRUTENLAGEN, IN DER FRÜHMITTIGER SEKTION ZUM WEIBLICHEN GENITAL, by Prof. Dr. D. B. Aschner, Wien. VERGLEICHENDE PHYSIOLOGIE DER WEIBLICHEN SEXUALORGANE UND DES SAATGEGESSES, by Prof. Dr. K. Heber, Wien. FERNLEBENSSTELLE UND REPRODUKTION (EGG) by Dr. J. Lenz, München. HORMONE UND DIABETES DES WEIBES UND ANDEREN IN SCHWANGERSCHAFT, by Prof. Dr. K. Borch, Stuttgart. FRAUENARBEIT UND FRAUENLEBEN, edited by Dr. M. Hirsch, Berlin. Berlin: Urban & Schwarzenberg, 924.

# AMERICAN COLLEGE OF SURGEONS

## THE METHOD OF PROCEDURE OF THE REGISTRY OF BONE SARCOMA

By E. A. CODMAN, M.D., F.A.C.S., Boston  
Chairman, Committee on Registry of Bone Sarcoma

TO explain the procedure of the Registry it may be best to begin with the illustrations which depict a box and its contents.

Plate I shows the face of one of the Registry envelopes which contains the data about one individual case. The first paragraph extending the full width of the page should now be carefully read.

It may be well to explain this paragraph in greater detail although it is very carefully worded and really covers all that is to be said in this article. The first sentence indicates the two-fold object of the Registry. Anyone who has had anything to do with a case of bone sarcoma knows that our knowledge of this disease is in a very unsatisfactory state. In spite of countless articles which have been written on the subject there is little agreement among roentgenologists, pathologists, and surgeons as to the diagnosis, prognosis, and treatment of any particular kind of bone sarcoma. This tendency to disagreement is also present when we consider the essential steps for the care of any individual patient as is simply illustrated among the cases we have already collected. Even the members of our committee fail to agree on such important problems as the use of nomenclature, the advisability of exploratory incision, or the choice between radiation and surgery. Therefore it seems that no one can deny that the subject needs studying whether or not it agrees with our method of studying it. Certainly these cases are bound to be experimental material. Any form of treatment given will necessarily be experimental, so the policy of the Registry is to urge that each individual case be treated and recorded—registered. Each case usually needs expert services from a radiologist, a pathologist, a surgeon, and often from other specialists as well, if the patient is to receive the benefit of the little that is known today. Even more than specialists in these individual branches, we need some one to co-ordinate opinions and advice and to interpret

the many confusing terms used. At present many of these bewildered patients go from specialist to specialist and from clinic to clinic, not only to their own detriment, but to the detriment of the standing of our profession and our hospitals in lay opinion. Each patient in his own experience finds out the lack of co-ordination in our hospitals. He finds that neither the hospital itself nor any individual in it sees his case as a whole and assumes the responsibility for his treatment. Eventually he and his friends face the facts that he is being rather aimlessly experimented upon, according to the interest or caprice of individuals, and they may even realize that little real use is being made of his experience for the benefit of other sufferers. Evidently these cases must continue to be the subjects of therapeutic experiments. The Registry merely asks that these experiments should be carefully done, carefully recorded, and carefully studied. The Registry is a means whereby the patients of each surgeon or physician doing these experiments can profit by the experiments made on other patients. Absolute publicity is its safeguard.

The second part of the first sentence shows that the Regents of the American College of Surgeons recognize this state of affairs and, as an example of the End Result Idea, recommend to the Fellows that they make a special effort to record and study every instance of bone sarcoma which comes to their knowledge, even though such cases have been wrongly diagnosed and treated ineffectively. The Registry has already accumulated enough examples of such errors and failures on the part of some of the most eminent members of the profession to show in any court of justice the difficulty of diagnosis and the great inadequacy of treatment in these cases. In asking from each hospital the registration of its cases the Regents in effect say: Errors in diagnosis and failures in treatment are to be expected in the majority of these cases. Nevertheless each hospital should be able to show that it has done



bone sarcoma alive at any one time in the whole United States. The effort of over 5,000 Fellows to register 1,000 cases should not be very great and the committee should have at least this number to make a satisfactory report, especially as experience has shown that in many cases important data such as X-ray plates or pathological material have been lost or destroyed. Our work has also already developed the fact that many cases treated under the diagnosis of sarcoma are in reality other conditions. Of the 428 cases hitherto registered the committee find only about one-fourth to be undoubted osteogenic sarcoma with data sufficiently accurate for intensive study.

One might say that since the disease is so rare why take so much pains about it. The answer is that it is to be used as an ideal example of what we should do in other rare diseases. The limited numbers make thoroughness possible. The registration of no case should be neglected.

One sentence in the paragraph on the envelope refers to the medicolegal responsibility in these cases. It is well recognized in court that no individual physician is liable for such errors as the failure to recognize a rare disease or the failure to cure a notoriously intractable one. On the other hand, in any disease frequent or rare, neglect or the failure to seek advice from colleagues, when in doubt, may at times be prejudicial. Any surgeon who promptly registers a case of bone sarcoma as soon as he suspects the diagnosis certainly shows his good faith and his willingness to seek advice. He then would have not only the benefit of the opinion of the members of the committee but in course of time the opinion of his many other pathologists who are studying these cases.

Another sentence refers to sending about boxes of these registered cases to various laboratories. A photograph of such a box is seen in Plate II. It is our policy to send the series of cases in similar boxes to each of the laboratories which are helping in the research so that many different surgeons and pathologists may see the same cases and each express in his own writing the name which he prefers for each particular case. As an example in Case 23 the following different terms were applied to the same lesion. Osteochondrosarcoma, fibrochondrosarcoma, chondrofibrosarcoma, sarcoma (chondro) spindle-cell sarcoma, mixed-cell chondrifying sarcoma, osteogenic chondrosarcoma, and osteogenic sarcoma.

Each recognized the same clinical entity but preferred a different term. Practically all are now using the term, osteogenic sarcoma, for this entity. Many such examples might be shown. At

present, most of those interested are using the terms in the middle column printed on the outside of the envelope.

Some of those who have contributed cases may feel that the committee should guard the envelopes more jealously and keep them in the Registry Office rather than send them about to other laboratories where they may be carelessly handled or injured in transportation. The members of the committee feel that it is far better to run the risk of losing some of the material than to lose the opportunity of having other minds study the data. The data of these individual cases may be lost, but other cases will be coming along. Observing minds once stimulated will be focusing their attention on the new ones. We are dealing with a difficult problem and we need all the help we can get, so we want to study the collection with other laboratories. Furthermore, the therapeutic side is interesting to all the laboratories on account of their own patients. By passing the collection about in this way each pathologist can himself weigh the evidence in those cases which have responded to unusual methods of treatment. At present this phase is particularly interesting on account of the wonderful results being obtained with radium and the X-ray, which are all regarded with suspicion when seen in print in the journals. Photomicrographs and half-tones are never as convincing as the slides and X-ray films themselves, which we send about in the envelopes.

Another reason for passing these envelopes about is that they set a commonplace example. Some clinics may perhaps refrain from registering their cases for fear that their histories, microscopic or X-ray technique, follow-up work, et cetera are not good enough. However, the committee finds that a well registered case is the exception, not the rule and to send about such data as we have is the best we can do. As time goes on the material becomes better and better. All departments in a hospital knowing that a case is to be registered take more pains, and this has already resulted to the benefit of the patients in several hospitals. Future cases will no doubt be registered in much better form, but the fact is that at the present date most hospitals could not, if they would, properly register their cases. The same slides, X-ray prints, et cetera have been lost or broken. Oftentimes the patients cannot be traced. But do not let this discourage anyone for it is true of almost every hospital in the country. Register your cases even if your data is inadequate as an evidence of good will, and then as soon as a new case appears take pains

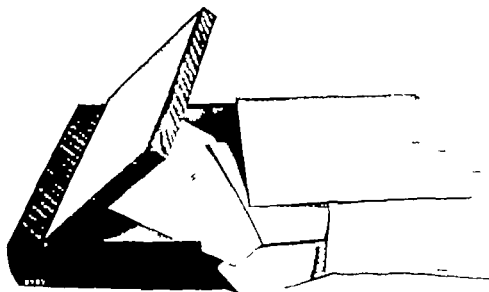


Plate II The box which is sent around to the various laboratories. Each box contains one series of registered cases.

to get us complete data that you are proud of. The example of those who have already registered cases knowing their evidence was inadequate and often ridiculous, is the great driving power of the Registry. The same may be said of the example of our consulting pathologist. They have been willing to write their diagnosis on very inadequate slides, often badly fixed and stained knowing full well that the future would prove many of their guesses wrong and even ridiculous to their own students. When such enthusiasm exists even the most skeptical should be willing to do their bit.

Finer in radiological and pathological technique is needed in bone sarcoma as much as in any lesion and clinics are taking more and more pride in proving they possess it. In some clinics the effort to get desirable technique in bone sarcoma cases will help to overcome the inertia which is influencing their efficiency in the treatment of other rare diseases.

And another potent reason for passing these envelopes about is to dispel any illusions to the effect that the committee is seeking to monopolize it. The collection is made by the College for the College and the public. Anyone, whether a member of the College or not who is doing his bit in contributing cases is welcome to share in the study of it. We send the boxes about to any clinic desiring to co-operate with us and are glad to give preference to those who have actually registered cases. If your clinic desires to co-operate, please notify the Registrar and boxes of

envelopes will be sent to you in rotation like a circulating library until, if you desire, you have seen the whole series. It is intended to have each box stay at each clinic not more than two weeks. When it is returned another box will be sent you. If you make your own prognosis in each case, in due time we can inform you whether you were correct for we intend to obtain follow up notes annually on each case registered.

On the face of the envelope in Plate I are three columns. The left hand column is a list of the terms frequently used in the literature to describe special features of bone sarcoma. It is the desire of the committee to call attention to the fact that these terms should not be used as clinical entities or even as subdivisions of clinical entities. In the middle column is found a list of clinical entities which was agreed on in joint conference by a committee of the Society of Clinical Pathologists consisting of W. A. MacCarty, F. Soderman, A. J. St. George and E. P. Bell, meeting with our committee. This joint committee could agree on any other clinical entities as stated in the paragraph in italics at the foot of the column.

"It is believed that this list covers all bone tumors which are known to have a natural history distinct enough to justify prognosis or to indicate special treatment. If you believe there are others please register illustrative cases."

The Registrar feels that our series contains at least a few examples of each of these entities, except angiosarcoma. Of this form we have no

definite example as yet registered but members of the committee felt that they had seen instances of this form in the past. However all agreed that most cases so diagnosed were probably really instances of erythrovascular osteogenic sarcoma—the so-called telangiectatic type.

We may therefore say that for clinical purposes we recommend an effort on the part of surgeons, roentgenologists, and pathologists to stick to the use of these simple terms in the middle column for they only mystify one another by attempting to use the other adjectives in the left hand column. The same principle applies to the teaching of student who may be taught the meaning of the adjectives but at the same time given to understand that the use of these adjectives is relatively unimportant from a clinical point of view.

For instance such terms as round-cell sarcoma and mixed-cell sarcoma are purely histological descriptions and are not significant of diagnosis prognosis or treatment except in so far as the use of the term sarcoma signifies a malignant new growth of mesenchymatous origin. A round cell sarcoma might be what we call a "myo tumor" or a myeloma and on the other hand what we call a "joint-cell tumor" has frequently been called a "mixed-cell sarcoma," round-cell sarcoma, spindle-cell sarcoma and combinations of these terms. If we are ever to get out of this mire of nomenclature and speak the same language we must take pains to distinguish between nouns and adjectives. It is better to avoid the adjectives entirely than to use them in the wrong way. Their use is seldom of any great importance for clinical purposes.

This applies to the other adjectives listed as well as to the cell terms—their correct use is difficult. The term periosteal, though commonly used in an almost synonymous way with our term osteogenic for the typical malignant tumor of bone is one we should avoid as far as we can. It will be pointed out later it can be used in its literal sense—adjacent to or around the bone—or as indicating origin in or involvement of the periosteum. The committee is forced to use it temporarily in two different ways. We mean by periosteal fibrosarcoma a group of tumors adjacent to the bone which we cannot prove to be periosteal in origin for they are indistinguishable from fascial sarcoma. On the other hand we use periosteal as a subdivision of osteogenic sarcoma. In this case we use periosteal in a different sense which perhaps is more synonymous with cortical as opposed to central. The reason we use these terms is because of our

belief that there are two different clinical entities, the former having a somewhat better prognosis, showing no periosteal new bone roentgenologically, and histologically indistinguishable from fascial sarcoma. The latter causes periosteal proliferation showing histologically evidence of osteogenesis and sharing the very bad prognosis of osteogenic sarcoma.

Many of the other adjectives can be readily misused and piled on top of one another to make phantoms clinical entities, but the experience of the Registry has already shown that in the fibro-osteochondro group, it is impracticable to get agreement among pathologists in the case of a single tumor. The list given in the middle column appears to be the greatest common denominator that can be arranged at present. On the inside of each box is posted the following explanation:

27 Beacon St. Boston January 1924

I have here set down interpretations of what I believe the joint committee means by the terms spread upon for common use by clinicians, roentgenologists, and pathologists.

I cordially invite the individual members of the committee or any of our consulting pathologists or any teacher or professor of pathology, roentgenology or surgery to sit me the classification or any definition of the terms.

If anyone believes that there are other clinical entities I should register some cases and let me pass them about from laboratory to laboratory for the opinions of others interested, as I wing has done in the case of his tumor. We should converse our conclusions before undertaking to teach the profession or our undergraduate students.

If anyone plans to use in his reports or to teach his students other forms of nomenclature as being preferable to those, as a whole or in any detail of importance we advise him to send us his improved nomenclature, its explanations and illustrative cases, and will enclose copy in each of these boxes as an alternative for this.

The Registry is in criticism as the spirit of co-operation.

E. A. CORBIN, M.D. Registrar

**Metastatic tumors.** Clinically the prognosis in these cases is usually rather stable. Roentgenologically they are usually central. Histologically they are usually true to the type of the original tumor to some degree and are seldom, if ever purely undifferentiated tumors in bone.

**Periosteal fibrosarcoma.** Clinically these are tumors which he next to the bone do not invade it although they may cause absorption by pressure on the adjacent surface of the bone. It is generally impossible to determine whether they arose in the outer layers of the periosteum or in the adjacent fascia or trabecular interstices. They appear to be less likely to metastasize than the osteogenic sarcomas. Roentgenologically they may show changes in the center of the adjacent bones even pushing the bones to one side or bending them but histologically they show no tendency to form osteoid tissue cartilage and bone. It is this that separates them from our class of periosteal osteogenic sarcoma which presumably arise from the osteoblastic layer of the periosteum. Periosteal fibrosarcomas are not distinguishable histologically from fibrosarcomas of the fascia.

3 *Osteogenic tumor* These are tumors which are believed to be derived from cells which are supposed to be the common ancestors of the cells which form bone, cartilage, the fibrous part of bone and the tissue formerly called synovium, back from the point of view of bone pathology is merely a phase of cartilage or fibrous tissue.

The benign forms are too well known to need special definitions.

The malignant forms are *osteogenic sarcoma*—true bone sarcoma. Clinically these grow the least and progress the slowest and the proportion of the different component parts, fibrous, synovial, cartilaginous or bony, has probably very little influence in the prognosis, which apparently depends on the activity and quantity of the undifferentiated cellular portions of these tumors. We have therefore abandoned the attempt to separate clinical entities according to the preponderance of any element. All forms have much the same natural history.

Röntgenologically these tumors are far more frequently near the ends of the bone than in the shaft, although exceptions occur. They usually show considerable amount of bone production, generally radiating outward, but the more cellular types may simply destroy bone and therefore show erosion and invasion röntgenologically without producing the characteristic radiating spicules.

Histologically these tumors usually show intercellular substance resembling fibrous tissue, bone cartilage or osseous as well as undifferentiated cellular tissue. Sometimes one or another of these elements predominates, but pictures, but usually all the elements may be found in some part of the tumor. Some are almost entirely composed of undifferentiated cells.

Certain anatomical types of these osteogenic sarcomas appear to be subordinate clinical entities. The component type is both medullary and periosteal, showing central bone destruction and subperiosteal bone proliferation. This type covers the great majority of cases. Occasionally one appears to develop chiefly in or under the periosteum, but the more our experience increases we more find that the difference of proportion of medullary and periosteal involvement, rather than that these tumors are essentially either periosteal or medullary. We have agreed that it is necessary to carry subdivision *periosteal osteogenic sarcoma* for the present. This merely means sarcoma which histologically has osteogenic characteristics but which is anatomically cortical or periosteal in situation.

It is a very difficult matter to offer terms which all be satisfactory for the clinical entities which we call respectively *periosteal fibrosarcoma* and *periosteal osteogenic sarcoma*, yet the committees feel that clinically röntgenologically and histologically they are different. It seems that *periosteal fibrosarcoma* has a better prognosis than *periosteal osteogenic sarcoma*. The terms are poor for *periosteal* is used literally in the former and as noting destruction in the latter.

It is very unfortunate that the term *periosteal sarcoma* has been widely used in this country as synonymous with malignant bone sarcoma (osteogenic sarcoma). It is also unfortunate that the committees feel obliged to retain the term *periosteal* and to apply it to two different entities still different from the much abused meaning. It is hoped that better terms will appear.

The amount of bone production in osteogenic sarcomas varies considerably. When it takes place through the great majority of the tumor, call it *advancing* (advancing) and it may be that this type has a better prognosis than the less advancing forms. On the other hand, certain cases are so vascular that they actually pulsate and grow with great rapidity so that it seems that the group of *telangiectatic sarcoma* is clinically of much poorer prognosis.

It seems probable that the accidental difference of degree of freedom of communication in arterial and venous spaces in the tumor accounts for this difference. We do not believe that the cellular constituents are actually more malignant than in the other forms, but that the presence of blood spaces lined by tumor cells and an almost direct arterio-venous communication allow the cells to be washed off directly into the circulation. The more vascular the tumor the less likely are the cell lined spaces to be in direct communication with the blood stream. It may be that the better prognosis *periosteal fibrosarcoma* can be explained by the infrequent occurrence of the cell lined blood channels.

Röntgenologically these anatomical entities are to certain extent recognizable. Histologically they are much the same eventually though the occurrence of much new bone or many blood spaces in section would suggest that sarcoma or telangiectasis could characterize the rest of the specimen. The real distinction is in the gross anatomy of the tumor. Telangiectatic spaces lined by tumor cells must be distinguished from atypical blood vessels, and confusion with angiosarcoma.

*Undifferentiated sarcoma* are carried under the osteogenic sarcoma because such tumors arising in bone may be presumed to be of origin in cells destined to produce bone. That is, believe that if these undifferentiated cells should produce any intercellular substance it could be fibro-myxoid, chondroid, osseous or osseous. The group of tumors which call long tumor perhaps should be placed in this class for some of our consulting pathologists, notably J. H. Wright think they recognize primitive osseous substance in many of these cases. However, I am inclined to believe them of endothelial origin and his opinion is gaining strength in the minds of others. Those who have studied the collection as a whole at least grant that this group is a clinical entity probably favorable for a better prognosis for radiation. At present carry long tumors under separate heading between malignant sarcoma and the myeloma, but it may be decided later that they belong with these undifferentiated tumors.

4 *Metastatic Condition* are placed in the central portion of the list because on the one hand, in a case of an extremely embolus which which approach malignant osteogenic sarcoma in their histology, and on the other hand there is also borderline in such cases as osteitis fibrosa and bone cysts where the question of new growth or inflammation is difficult to decide. Some pathologists, notably Mallory even include under inflammation our next division giant cell tumor. Röntgenologically in inflammation may simulate new growth so exactly that in many cases diagnosis cannot be made. Histologically the same dilemma is present in a considerable number of cases and one has to ask for help from knowledge of the course.

Under inflammation is placed *osteitis fibrosa*. We recognize this as useful term to include such forms of osteitis as Paget disease on Recklinghausen's disease, and the anovus forms of single and diffuse cystic disease of bone which have not yet received definite pathological standing. These cysts being under this heading too, though they merge into the following.

5 *Benign giant cell tumor* A term used by Bloodgood to replace the old term giant cell sarcoma is accepted by the Registry. The term is suitable for educational purposes. Many surgeons and pathologists are brought up to regard this type of tumor as more or less malignant. Up to the present that the Registry has found no instance of clear case of one of these tumors causing metastases. Röntgenologically they are central tumors expanding the bone locally giving very different picture from the



osteogenic sarcoma. Histologically this type is also distinct although our consulting pathologists have not yet agreed on the probable histogenesis of the tumor. Any one studying the Registry cases will feel very sure of well-marked separation of these tumors as classical entity and feel convinced that they are benign, whether or not he agrees with Blafford that they are essentially inflammation and repair phenomena.

6. Instances of benign epineurial sarcoma occur in various structures similar to cavernous epineurial in the soft parts. Roentgenologically they rarely bone and expand to something the same as that giant cell tumors do, but the larger and smaller kinds. A belief that malignant tumors of the blood vessels occur in bone but we have as yet registered no case which is typical angiosarcoma. Many supposed angiosarcomata are probably telangiectatic osteogenic sarcomata.

7. *Shaft tumor*. This tumor generally involves the shaft of the long bones producing shrinking of the shaft, apparently by spreading about the lamellae of the bone. It may involve the shaft or the short bones. It is more apt to be multiple than true osteogenic sarcoma. Roentgenologically it shows characteristic longitudinal striation and the tumor itself is usually of course more than half of the shaft. It does not often produce the radiating spicules, but there may be some like in cases of peripheral new bone formation as one sees in osteomyelitis. The roentgenological appearance is usually confused with osteomyelitis. It is an unusual bone-destruction tumor rather than bone producing one but it may set up reactive formation of new bone in ordinary bacterial infection. Histologically it is composed of undifferentiated round and polyhedral cells arranged in a peripheral manner about the periphery, appearing in sections in nests between the lamellae. Its histology is very characteristic. It progresses fast but these tumors yield to treatment temporarily to radiation such the osteogenic sarcoma seldom do in any great extent.

8. *Multifocal*. These tumors are almost always multiple. They are central tumors and not bone producing. Roentgenologically they show no bone proliferation and are usually clearly defined, but many at times show invasion of the bone in a moth-eaten way resembling the characteristic picture of cancer. Histologically the cells resemble the myeloid series. The histological diagnosis rests on these resemblances. There is said to be no element derived from the erythrocytes but in such case has as yet been registered. For clinical and roentgenological purposes it is necessary to include the erythrocytes even histologically. The boundary lines are very difficult to draw and for practical purposes the histological analysis are the same classical entity. They are invariably fatal, although local improvement with the X rays may occur and the disease be postponed for many years.

*Borderline cases*. The nomenclature is arranged on the same principle as the Classification Sheet in each classification, that the entity which are likely to be confused should be put to one another. In including the Registry in which is doubt between different borderlines.

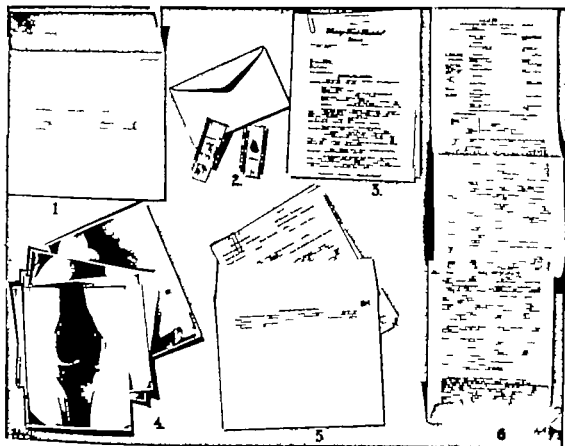
These definitions are probably not wholly satisfactory to every member of the joint committee, but they suffice for a working classification for the present. The best way to amend them would be to register exceptional cases which cannot be classified under any of these definitions. These exceptional instances could thus be passed about to the individual members of the committees and

their consulting pathologists until the new entity becomes established. There are already registered certain cases which the Registrar finds it difficult to place, but in most of these cases the data are unsatisfactory or incomplete. However they may be more intelligible when other similar cases more perfectly registered have been added.

The Registrar would like to take this opportunity to stress the importance of immediate fixation of tissue especially when it is taken at an exploratory operation for diagnostic purposes. Apparently few surgeons realize that immediate fixation of cells makes such an important difference to the pathologist in giving an opinion. A few little scrapings half dried up are too often handed to a pathologist. When exploratory operation is justified at all, a good size piece of tissue cleanly cut well down into the tumor should be taken. This piece should be divided in halves and one half immediately fixed in 10 per cent formalin and the other in Zenker's solution. When possible the Registrar would be glad to receive these or blocks in addition to the slides.

The following suggestions are also made to roentgenologists. Whenever you take X rays of a bone tumor suspected of being a sarcoma, put two films in the plate holder at each exposure. Then you will have an extra one of each to send to the Registrar. If you have only one film, make a duplicate for us by placing this on a blank film in the dark room and turning on the light for a moment.

The Registrar needs the co-operation of roentgenologists as much as that of pathologists and surgeons. The hope of early diagnosis rests especially with the roentgenologist. Furthermore in the opinion of our committee a roentgenologist is quite justified in treating a case of bone sarcoma without help from the pathologist or the surgeon, but to be fair to his patient and to future patients with this disease he should register his case. The committee will be ready to express an opinion on the history and X rays even if no exploratory operation has been done. In many cases it is better to base opinion on these data than from minute bits of tissue wrapped from the surface of a single portion of the tumor. In view of the slight evidence of the curative value of surgery and in view of the relatively small numbers of cases as yet treated by radiation we are not in a position to state that treatment by radiation alone is better or worse. The chances of doing damage as well as doing good must be carefully balanced. It may be better to make the error of treating a benign condition occasionally by radiation than to slip up all the malignant cases by exploratory surgery. It remains to be seen by which method



Plat III Contents of registry en elop

prolongation of life and comfort are best secured. The Registry is not in a position to give any definite opinion, but if all cases are registered we may in time be able to answer the question more logically than can the advocates of any particular therapeutic measure. The important thing now is to record the facts, and later when sufficient members have accumulated conclusions may be drawn. And the same facts can be analyzed by the advocates of both forms of treatment. At present these important decisions are made on the vague personal opinions of the surgeon in charge of the case, perhaps in consultation with some other equally wise surgeon of wide experience. And what else can we do until the Registry has collected the facts?

#### CONTENTS OF A REGISTRY ENVELOPE PLATE III

Each envelop is arranged on a uniform plan so far as is possible, for the convenience of our consulting pathologists.

Figure 1. On the back of the envelop is pasted a brief typewritten abstract of the case history with a note of the date and condition of the patient when he or she was last heard from. On the under side of the flap is noted the contents of the envelop. The assistant registrar checks up this list of contents (to make sure nothing has been lost or mislaid) as soon as each box of cases has been returned by a consulting pathologist. To facilitate this and to aid anyone who works with the cases, each article in the envelop is numbered with the case number—every slide print, or sheet of paper.

Figure 2. A small manila envelop containing the slides.

Figure 3. The history of the case. We do not ask for great detail in the history for if occasion arises we can write for more facts.

Figure 4. Prints of the X-rays or photographs of patient or gross specimen. We prefer films since they often give details which the prints do not.

**CASE NO.**

A CLASSIFICATION OF BONE TUMORS FOR USE BY THE MEDICAL

Each case in the Registry to be placed by the Registrar in one of three spaces for documents and temporary circulation.

	Primary in Cancer	Secondary	Metastatic	
Primary in Cancer other than bone				1. Common metastases are local invasion of bone from outside.
Benign				
Showing metastasis by size and amount of endosteal reaction				2. Endosteal type usually metastases but possibly primary bone.
Benign				3. Fibro and osteoclasts and clearly benign.
Differentiating toward structural pattern of bone				OSTEOCLAST METASTASIS.
Benign				4. Disruptive metastases between surface or outside and osteoclast reaction.
Inflammation and Repair				5. Representative for reaction not primary metastasis
Benign				
Good Cell Turnover				6. Refined, orderly, and phases of growth and repair.
Benign				
Differentiating toward endosteal				7. Bone's endosteal.
Benign				
Differentiating toward surface cells				8. Metastases, Multiple epithelial.

**OSTEOCLASTIC**

Primary and secondary  
endosteal reaction

Disruptive  
secondary  
osteoclasts  
epithelial, fibro, etc.

Simple Bone Epith.  
GOOD CELL TURNOVER

Disruptive  
secondary  
osteoclasts  
epithelial, fibro, etc.

Disruptive  
secondary  
osteoclasts  
epithelial, fibro, etc.

**OSTEOCLASTIC METASTASIS**

Disruptive  
secondary  
osteoclasts  
epithelial, fibro, etc.

Disruptive  
secondary  
osteoclasts  
epithelial, fibro, etc.

Disruptive  
secondary  
osteoclasts  
epithelial, fibro, etc.

Disruptive  
secondary  
osteoclasts  
epithelial, fibro, etc.

Detail of Fig. 6, Plate III. The classification sheet

Figure 5. A smaller lighter envelop which contains correspondence and other data not essential to a review of the case. The object of this envelop is to avoid a confusion of papers when our busy consulting pathologists are reviewing a case. Usually they will not need to look at these papers, but it is considered better to supply all data we have about each case so that if they are in doubt they may glean some more information.

Figure 6 This is the classification sheet which was used by the committee before the formal classification printed on the outside of each envelop was arrived at. The chart at the beginning of the sheet was used to classify our first cases because at that time the clinical entities had not become as distinct in our minds as they have now after 3 years of work. Borderline spaces were provided and the entities arranged as we

still arrange them in the new classification, so that as far as possible similar entities were side by side with a borderline between. So, also, across the page there was a borderline between the benign column and the malignant column.

This classification sheet is still quite useful perhaps more to lend our minds than anything else. For instance, the Registrar here in doubt of how to classify a case could frequently pigeon-hole it in one of these spaces even without naming the condition. In Dr. McClure's case which is illustrated in Plate III even after consultation with the other pathologists no definite prognosis could be given, in spite of the fact that it is all registered with an excellent history, slides, and X-ray. In other cases there would not only be doubt in prognosis but doubt in histogenesis as to which the critical borderline spaces are used.

The main reason, however for continuing to carry this classification sheet in each envelope is to provide a definite place where those who are studying the cases may enter their diagnoses and make any remarks which they think will be helpful to others who follow them. The Registrar has been unable to induce the consulting pathologists to be as detailed in their criticisms of each other's views as he would like to have them. To differ in the name given the tumor is not enough. Each pathologist should say why he considers the other wrong or why he thinks he is right. At any rate the classification sheet is for this purpose and in some cases the Registrar's hopes have been fulfilled.

The printed matter is explanatory of the problems we are facing. It is intended to be educational and to provoke discussion. It is unnecessary to print it here, but it should be read by anyone planning to co operate with us. In fact the first step for anyone beginning a study of our cases is to be sure that he understands all the printed matter on a box or in it.

The Registry is now well started. Nearly 450 cases are already registered. Twenty-odd laboratorians are receiving and studying the boxes of cases. It remains to be seen whether the Fellows of the College will do their bit by registering the cases that come to their knowledge. If the American College of Surgeons is to be a success, this is

one of the ways in which it can show that it is ready to practice what it preaches. Let us put at least one small class of cases on record as an ideal example of what we should like to do for all rare cases if the exigencies of life did not make such detailed study impossible. No surgeon sees so many of these cases that he can put forward the excuse of lack of time. No hospital is so poor that it cannot afford duplicate X rays, duplicate slides, and duplicate histones of its few bone sarcoma cases. To register every case in the United States and Canada is not an impractical task. It merely requires the zeal to do it, and this zeal is simple justice to each patient.

We must trust to the Regents of the College not to overburden us with such registries. Let us make this one a complete success before starting others, and to be successful it must continue for many years yet. Eventually this collection of envelopes will be stored in the Museum of the College as an example for a modern pathologic museum. Instead of isolated dried specimens of curiosities often without histones, our new museum will have a series of complete case histories for each recognized clinical entity. It will become a real honor to have been among the first to register a new clinical entity or even to have helped by registering one case in this first series, which by the very nature of the disease is bound to be a record of error and failure.

## OHIO STATE SECTIONAL MEETING OF CLINICAL CONGRESS

THE Ohio State Sectional Meeting of the Clinical Congress of the American College of Surgeons for 1924 was held in Columbus on March 24 and 25. The arrangements were in the hands of a local committee with Dr. Wells Teachnor as chairman. Dr. Charles Hamilton, the chairman of the state committee presided at the meeting of the Fellows of the College on the afternoon of the first day.

The following officials for the state were elected for the coming year:

Chairman—Charles S. Hamilton, Columbus

Secretary—James A. Sherbondy, Youngstown

Counselor—Albert H. Freberg, Cincinnati

A good clinical program was provided at the local hospitals on both days. The hospital meeting was held in the Ball Room of the Deshler Hotel at 2:00 p.m. on Monday, March 24. There

was a good attendance and an interesting discussion of topics relative to hospital service.

The public meeting was held in the Ball Room of the Deshler Hotel at 8:00 p.m. on the evening of the first day.

From 11:00 to 12:00 noon on both days clinical addresses were given in the Assembly Room of the hotel by Dr. A. J. Ochsmere and Dr. George E. Shambaugh of Chicago.

The scientific meeting in the Assembly Room of the hotel on Tuesday afternoon at 2:00 o'clock was largely attended.

The visiting speakers were Dr. A. J. Ochsmere, Chicago; Dr. George E. Shambaugh, Chicago; Dr. F. P. Vinson, Rochester, Minnesota; Dr. Malcolm T. MacEachern, Chicago; Rev. C. B. Moulmer, S. J., Milwaukee; Rev. Frank C. English, Cleveland; and Dr. Allan Craig, Chicago.





Fig. 44 The rectum has been excised and an exact watercolor picture made of the external surface of the gross specimen excised. 45 The rectum has been laid open and an exact watercolor drawing made of the cancer thus its typical growth and is the most frequent location of cancer of the rectum in the excisable stage.

*Principles of the Operation for Carcinoma of the Rectum —Robert C. Coffey*

# SURGERY, GYNECOLOGY AND OBSTETRICS

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## PRINCIPLES OF THE OPERATION FOR CARCINOMA OF THE RECTUM<sup>1</sup>

By ROBERT C. COFFLA M.D. F.A.C.S. PORTLAND OREGON

COMPLETENESS is the most important desideratum connected with a surgical operation for cancer. Considered biologically, from the standpoint of the mere eradication of the cancer itself, completeness is the ideal to be sought. Considered broadly in the interest of the patient, this ideal must sometimes be modified. For instance, the Wertheim operation for cancer of the uterus is ideal from the standpoint of removing the cancer, but it is the opinion of a great many very competent surgeons that the increased mortality following this radical or ideal procedure more than outweighs the increased number of permanent cures. In other words, it is the opinion of most surgeons that a modified operation is advisable as a general rule, in that the modified operation in a thousand given cases of carcinoma of the uterus will probably add a greater total of comfortable days of life than would be observed in a thousand patients treated by the more ideal method of Wertheim. The complete block dissection for cancer of the neck, including the removal of all the vital tissues such as the carotid artery, jugular vein, and even the pneumogastric nerve, is ideal from the standpoint of removal of the cancer, but we are always called upon to decide whether it is ideal from the standpoint of the patient. The same is true of cancer of the lower jaw or base of the tongue, for which a surgeon, by a

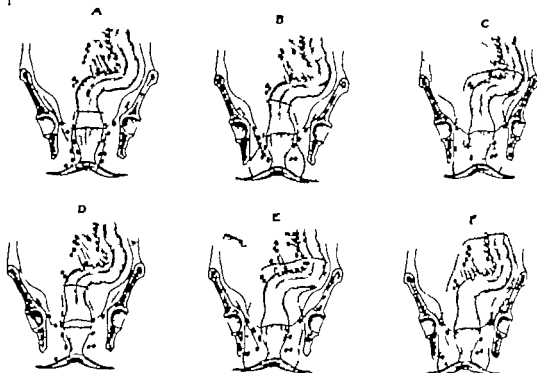
series of daring surgical maneuvers, removes these organs.

Some surgeons in operating for cancer of the uterus use the cautery and attack the most inoperable cancers, well knowing that more than likely both the rectum and bladder will be opened in the procedure if the operation is to be thorough. They seemingly disregard the other organs on the ground—as I once heard a surgeon say, "We are dealing with cancer. We must remember also that we are dealing with a patient—a human being."

Cancer of the rectum has in the past been placed in this same category of borderline operability. The old Kraske one-stage operation giving a mortality of 25 per cent or more with no control and no means of taking care of the fecal contents, was a most formidable affair. Who would want to be operated upon under such circumstances? Quite a few, no doubt, but many of those choosing the operation would doubtless be quietly hoping to belong to that more fortunate 25 per cent or more of fatalities. It is this most terrible and mutilating of operations that has caused surgeons from time to time to try more conservative procedures by which the sphincter muscle could be preserved. Unfortunately, the growth returns, the patient has very poor control at best, and nearly all surgeons have abandoned the effort to preserve the sphincter



1



**Fig. 1.** a. Diagram showing the restricted nature of Kraske's operation. The rectum is merely dissected out as a tube containing cancer and the vulnerable tissues of the upward, lateral, and downward zones of spread are left. (Miles)

b. Diagram showing the first step in the evolution of the radical operation. The perianal skin and the ischio-rectal fat are widely removed as these tissues have been found vulnerable to recurrence. (Miles)

c. Diagram showing the extension of the operative field as a further step in the evolution of the radical operation. In addition to the perianal skin and the ischio-rectal fat all of the levator ani muscles and the lower part of the pelvic mesocolon are included as these tissues are found to be highly vulnerable. (Miles)

d. Diagram showing the limited character of the removal in personal resection and sigmoid resection. (Miles)

e. Diagram showing how much of the vulnerable tissues of the three zones of spread is left behind by the abdominal anal operation. Even here the proximal end of the colon is brought down to the anus, the vulnerable tissues of the lower zone are left. (Miles)

f. Diagram showing the final stage in the evolution of the radical operation. Whereas the vulnerable tissues at the lateral and downward zones of spread may be removed completely by an operation carried out from the perineum alone the greater part of these contained in the upper zone remains out of reach. These tissues, which correspond to the antra in the breast operation, can be removed only by the radical abdominoperineal method. (Miles)

apparatus at the lower end of the rectum for with a properly made colostomy in which the intestine is brought out through the left rectus muscle the patient is by no means uncomfortable. Some such apparatus as the Delatour bag effectually serves as a reservoir to store the bowel contents. With this point settled we are free to do a complete operation for cancer of the rectum. By completeness, we mean complete devascularization and removal of the involved and contiguous area. By devascularization we mean the cutting

off of both the blood supply and the lymphatic and venous return circulation.

Contrary to the established belief there are few parts of the body so favorably situated as the rectum for complete devascularization and removal of all the involved tissues in case of cancerous invasion. Most of the blood supply for the ampulla of the rectum and the recto-sigmoid as well as that of the connective tissue and fat found in the hollow of the sacrum, comes through one vessel—the superior hæmorrhoidal artery. Most of the return

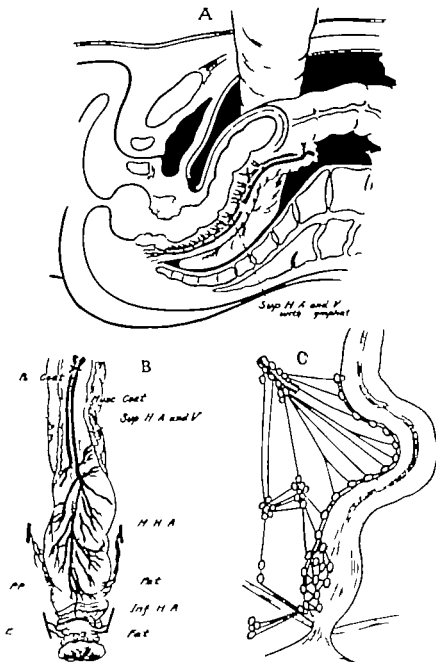


Fig. Complete devascularization from above is possible by ligation of the superior hemorrhoidal vessels at the promontory of the sacrum. Note arteries, veins and lymphatics. *b*, Direct view of superior hemorrhoidal vessels and lymphatics which occupy the retrorectal space. The ligation of these vessels devascularizes the ampulla of the rectum and rectosigmoid. *c*, Illustration of Miles' picture showing the lymphatics of the rectum.



circulation goes back through corresponding veins and these vessels are accompanied by the lymphatics, which together serve as almost the sole avenue for the spread of the disease upward. These vessels may all be included in a single ligature placed opposite or just below their crossing of the promontory of the sacrum in the mesosigmoid. It will be seen by the composite colored plate (Fig. 2) that this ligature at once severs the blood supply and the venous and lymphatic return circulation thereby removing the danger of hemorrhage as well as upward metastasis during the further progress of the operation.

The article of Mr. W. E. Miles, which appeared in the *British Medical Journal*, and was abstracted in the *INTERNATIONAL ABSTRACT OF SURGERY*, gives a very lucid description of the lymphatic circulation and also a very clear description of the method of the spread of cancer of the rectum as follows:

Operation undertaken for cure of cancer must be based on the pathological findings and the field of operation must embrace all tissues apt to become invaded. The question of operation therefore necessitates a knowledge of the method in which cancer of the rectum spreads and the paths it takes. The early stage of adenocarcinoma of the rectum is confined to the mucous membrane and submucous tissue. It is sessile and readily movable upon the subjacent muscular coat gradually increases in size and spreads in three distinct ways:

- 1 By direct extension through continuity of tissue
- 2 Through the venous system
- 3 By means of the lymphatic system

*Spread of growth by direct extension through continuity of tissue.* Although the tumor is freely movable at first it soon becomes adherent. Extension takes place in all directions, but more in the transverse than in the longitudinal axis of the bowel. Adherence begins at the center or the oldest part of the tumor but surface extension may progress more rapidly in one direction than another thus fixing the indurated portion nearer one lateral margin than the other. It is difficult

to determine how long a growth has been the present. From observations of tumors in ampulla of the rectum however it may be inferred that by the time three-quarters of the circumference of the bowel is involved the growth is more than 1 year old. While the growth is extending around the circumference of the bowel infiltration of the muscular coat is taking place. This penetration continues until it is arrested for a time by the lymph sinus between the outer surface of the bowel and the surrounding fatty tissue. The growth finally extends across this space and involves the perirectal fatty tissue and the fascia propria of the rectum. Penetrated fixation to the sacrum prostate bladder uterus or vagina is impossible until the fascia propria has been involved. This would not occur therefore until a year after the earliest symptoms indicating the presence of the growth. Direct extension of carcinoma of the rectum is comparatively slow and invasion of the surrounding tissues does not take place until the greater part of the circumference of the bowel has become involved.

#### *Spread of growth by the venous system*

Microscopic specimens afford evidence of direct invasion of venous radicals. It is therefore easy to understand how even in an early stage cancer cells may be detached and carried to a great distance from the primary growth especially to the liver. Fortunately this mode of spread is rare and definite liver metastases are generally a late manifestation.

#### *Spread of growth by the lymphatic system*

The most important route by which cancer cells are disseminated is through the lymphatic channels. In the rectum there are two distinct sets of lymphatic channels by means of which such spread takes place, i.e. the intramural and the extramural lymphatic systems. Dissemination in the intramural system is of very limited extent. The general scheme of the extramural lymphatic channels is represented in Figure 2 c. The various tissues traversed by these vessels are vulnerable to metastatic deposits. Corresponding to the three lymphatic areas there are three zones of spread: (1) the zone of downward spread which includes the perianal skin, the ischio-rectal fat, and the external sphincter muscle.



Fig. 3 The sigmoid is mobilized by cutting the peritoneum on each side of its mesentery. Dotted line indicates incision of peritoneum of cul-de-sac around rectum and between bladder and rectum with long handle angle scissors.

(2) the zone of lateral spread which embraces the levatores ani muscles, the retrorectal lymph glands, the internal iliac glands, the base of the bladder and the vesiculae seminales, and in the female the posterior wall of the vagina, the cervix uteri and the base of the broad ligament with Poirier's gland and (3) the zone of upward spread which includes the pelvic peritoneum, the pelvic mesocolon in its entirety, the paracolic lymph glands and the group of lymph glands at the bifurcation of the left common iliac artery."

The author concludes that early growth in cancer of the rectum may metastasize widely into these zones and cannot be detected by ordinary rectal examination. He says: "The peritoneum especially that portion which lies on either side of the parietal attachment of the pelvic mesocolon is very often the seat of growth. Deposits, no doubt, begin in the subperitoneal lymphatic plexus, and the small intestine coming into contact with an exposed plaque, may become infected and cause widespread dissemination. The pelvic meso-

colon is also very frequently the seat of metastatic deposits even in early cases. Lastly the paracolic glands may become the seat of metastasis. Cancer cells do not spread according to the anatomical lymphatic distribution but according to laws of their own. Thus metastasis may occur in any or all of these zones irrespective of the position of the primary growth."

Cancer of the rectum regardless of its position, is apt to spread to the tissues of the three zones described. The most vulnerable of these are the ischio-rectal fat, the levatores ani muscles, the retrorectal glands, and the pelvic mesocolon. Therefore, these tissues must be freely removed in an operation for cancer of the rectum.

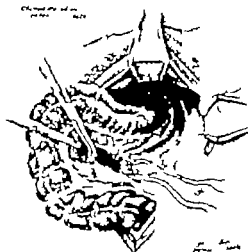


Fig. 4 Two ligatures placed around the superior mesenteric vessels, clamped about an inch apart. The superior mesenteric artery tied on one side and clamped on the other.

Figure 1 was taken from Miles' article and has been redrawn for the purpose of making more graphic the important lines. These figures show the relative thoroughness of the various operations which have been done in the past and Figure 1 represents the ideals of thoroughness to be sought after. This plate with Figure 2 which represents a composite picture of the important vessels to be noted in the operation for cancer of the rectum, together with the succeed

ing pictures in this article, will give the reader a graphic view of the enormity of the operation for removal of cancer of the rectum.

Up to this point we are prepared to say that in the first place it is possible to provide an artificial anus that permits a relatively comfortable continuation of life thus disposing of one of the drawbacks of the original Kraske operation. Second its anatomical relations to other organs, and the arrangement of its vascular and lymphatic supply makes it possible to remove a cancer of the rectum more completely and radically than almost any other cancer connected with the body. To undergo this radical operation is a tremendous strain on the vitality of the patient, for as will be seen by these first two illustrations taken with those describing the technique for performing it, the abdomen must be opened and explored, the lower pelvic colon must be removed with all the fat of its mesentery and the fat found back of the rectum in the hollow of the sacrum and in the ischio-rectal space all the levator and sphincter and muscles and in front all the connective tissue up to the vagina in the female and the bladder prostate, and urethra in the male. There is much sewing to be done in this operation which requires a great deal of

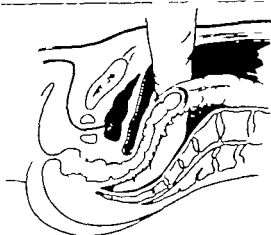


Fig 6 Sectional view of Fig 5

time. In short, the radical operation for cancer of the rectum is one of the largest in surgery.

While it is true that some prefer the one stage operation I am very sure that the average operator equally skilled in doing both the one-stage and two-stage operation, will obtain better results with the two-stage. While some individual patients have reparative material sufficient to make repair and at the same time keep up defense against infection throughout all the area involved in this operation, a large percentage of patients can not put up the necessary defense all at one time. In attempting to do several operations in different parts of the body at the same operative session, I have frequently noticed a break-down of the defensive even to a point at which a clean abdominal incision would fail to unite. Therefore it seems conservative and wise in very large operations to give nature all of her defensive forces with which to produce an unbroken physiological mechanism before the entire burden of repair is thrown upon her. And after the principal avenues of extension have been severed or devitalized we can then safely give the natural forces time to make the necessary repair for a complete and physiological mechanism before the final stage of the operation is to be done. In the early part of my work I attempted to do the second operation too soon, say within 4 or 5 days after the first,

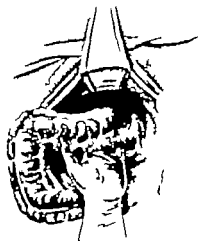


Fig 5 The fingers of the left hand are shown dissecting between the severed ends of the superior hemorrhoidal vessels and between the cut peritoneal edges of the mesosigmoid, are lifting the fat from the hollow of the sacrum down to the coccyx.

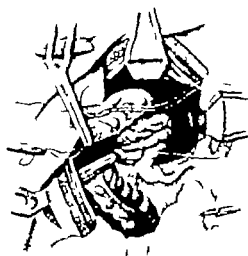


Fig. 7. Clamping and cutting the sigmoid after the ends have been ligated. Note that one of the clamp pieces through the stab wound in the rectus muscle.

and was often disappointed by the breaking down of an uninfected abdominal incision or the giving way of the peritoneal surfaces after a sutured. I therefore venture the dogmatic assumption that in order to get the best results, it is necessary to do this operation in two stages, for I contend that the extent of the operative procedures cannot be greatly abridged if we are to obtain the best permanent result. It is further interesting to note that no more radical operation can possibly be done if we are to have proper regard for the interest of our patient. I am in line with the statement at the beginning of the article: any growth which involves other vital organs in the pelvis, such as the bladder, ureters, or the sacrum, should be considered inoperable when taken from the standpoint of the patient and should be treated by palliative measures.

Up to this point I think we may reasonably assume first that we can comfortably dispense with the organ inolved. Second the involved organ is so situated constructed supplied and drained that it may be removed without seriously involving other organs. Third it can more safely be thus



Fig. 8. Proximal sigmoid has been fastened to layers of abdominal wall and its end held closed by clamp. Tube is passed up (1) end of abraded sigmoid, here it is fastened by strong double suture passed through the mesentery and mesocolon of tube and tied. B. Probing on the tube the sigmoid is unroofed and drawn out through the skin.

radically removed by utilizing the two stage principle.

We are now confronted with the question: What two stage method will assure a complete operation with the least drain on the vital forces of the patient with a resultant minimum mortality? It is not the purpose of this paper to discuss the relative value of the work of the great men who have led the way and shown us the possibilities in this field of surgery except in so far as it immediately concerns the principles under discussion. Suffice it to say that in all my early work I faithfully attempted to follow the work of Drs. W. J. and C. H. Mayo whose work constituted largely a co-ordination and clinicalization of the best methods of European and American surgeons with their own original work and I think it will be generally conceded that certainly no better work has been done than that at Rochester. It was only about 10 years ago that I began to change

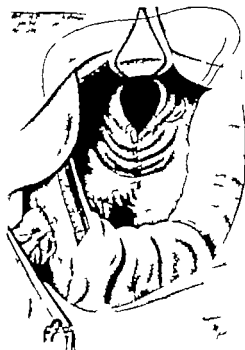


Fig. 9. After the space between the sigmoid and the left lateral parietal peritoneum has been closed by suture continuous calgut is run along the mesosigmoid covering the raw left edges with peritoneum down to the narrow pelvis of the cul-de-sac, here drain is inserted.

my methods from the established methods used there. In the meantime a number of other men such as Lockhart Mummery, Miles, Jones of Boston and others were also varying the established technique. I shall not discuss the relative merits of these various procedures but rather the principles involved in the whole subject as indicated in the title.

As has been said the lowest mortality with the old one stage Kraske operation was, as far as I know, achieved by the Mayos and was about 25 per cent. The first great drop in the mortality rate was when the two stage principle was adopted. In this operation a simple colostomy was made. A few days later the last segment of the sacrum with the coccyx was removed and the radical operation performed. I did most of my work by this method for several years but I am sure it is not possible, certainly not for me to do anything like as complete operation by this method as by the one we are now using.

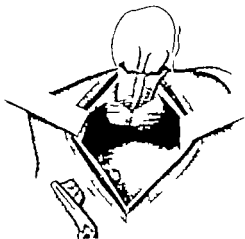


Fig. 10. The suture line continues to bring the parietal peritoneum from the sides of the narrow pelvis around the drain until the abdominal incision is reached, making the drain extraperitoneal.

Furthermore as far as I know when this method was in vogue no one was able to bring the operative mortality below 12 or 15 per cent. I appreciate that the operative mortality would vary to a great extent according to the completeness of the operation but I think the degree of completeness can be definitely standardized as to the amount of tissue removed and also as to operability and inoperability by the very definite lines we have already suggested in the paper and which Miles has so accurately diagramed.

The first question the operator has to decide is: What part of the operation is to be done at the first stage and what at the second? My belief is that the best results are obtained when the following principles are adopted for the first stage:

1. A completed physiological abdominal mechanism must be provided which is not to be disturbed afterward.

2. Complete devascularization of the involved and adjacent tissues from above. At the same time the devitalized structures must be mobilized and pushed down within easy reach of a sacral or perineal incision.

3. Separation of the retained physiological area from the discarded area by a quarantine pack which also serves the purpose of draining.





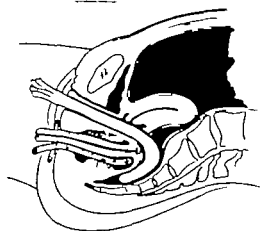


Fig. 3 Sectional view of quarantine drain surrounding inverted end of growth and emerging from the sigmoid.

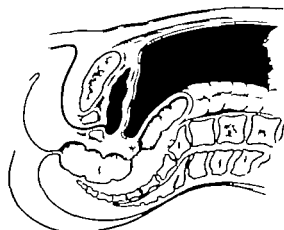


Fig. 4 High rectal cancer producing structure.

severed between the clamps, leaving the lower clamp on the stub of the rectum and removing the growth with all the intestine and devitalized fatty tissue above. The lower clamp was allowed to remain on the distal end of the rectum and its long handle brought through the peritoneal encasement along with the drain or quarantine pack. This additional technique was presented before the American Medical Association in 1922 and published in *Annals of Surgery* October 1922.

Having proved the practicability of this step it was easy to apply it to the only remaining class to which these principles had not been applied namely a low growth the caliber of which was not sufficiently large to permit of the passage of a rectal tube upward for the purpose of invaginating and bringing down the upper end of the sigmoid through the anus. In this class of cases, the steps of the operation are the same as the one just described except that the part of the gut above the growth is doubly clamped and severed between the clamps, the intestine included in the upper clamp along with all the fat in the hollow of the sacrum is removed at the first operation while the lower clamp is brought out through the drainage tract along with the quarantine pack or a ligature may be tied around the stump of the intestine in place of the clamp. The growth remains until the second operation.

With the successful adaptation of these three fundamental principles to all these classes of cases, they become universal in all cases of operable cancer of the rectum and this universal adaptability we feel justifies us in saying that we are dealing with principles rather than technique. As my experience has grown, I have gradually extended the amount of work done at the primary operation until it has become necessary to make a slight change in nearly all the illustrations dealing with technique.

There are three types or degrees of cancer of the rectum which require variation in technique in carrying out the three fundamental principles set forth. The most frequent cancer encountered in a routine clinic is a cancer located in the ampulla of the rectum which has not yet produced anything like a total obstruction. The second most frequent is cancer of the rectosigmoid in which obstruction is one of the earliest symptoms. The third in frequency is an extensive cancer located in or below the ampulla in which obstruction is marked but in which the growth is still removable. There is also a difference in the application of the third principle in man and in woman for obvious anatomical reasons. The first description of technique will in order of importance be that for an unobstructing cancer located in the ampulla of the rectum of a man inasmuch as cancer



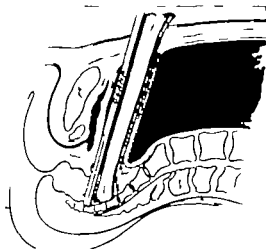


Fig. 7 The handle of clamp holding stub of rectum is brought out through peritoneal incision with cigarette drain.

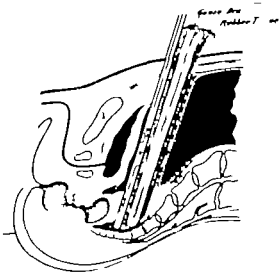


Fig. 8 Obstructing low cancer of the rectum. Devascularisation and removal of sigmoid haemorrhoids performed as in the standard operation. A clamp has been placed on the intestine above growth and brought out with the cigarette drain.

up on the opposite side and brought through the mesentery and around the large vessel and tied very tightly in order to squeeze out the fat in the mesentery. A similar ligature is placed an inch lower down. The mesentery including the artery and vein is now severed between the two ligatures. The sigmoid arteries coming from above are grasped in forceps and ligated so as completely to cut off the circulation from this source (Fig. 4). The fingers of the left hand are then insinuated between the ends of the severed superior mesenteric artery and also between the cut edges of the mesentery and pushed downward along the hollow of the sacrum thus stripping off all the fat and connective tissue down to the tip of the coccyx (Figs. 5 and 6). If there is any return bleeding in the cut mesentery from below this is stopped by grasping with forceps. After this separation a large temporary gauze pack is placed in the hollow of the sacrum back of the rectum while the second major step of the operation is performed.

Before beginning this second step we carefully determine the vitality of the circulation in the upper sigmoid which is to be used for permanent colostomy. It is very important to have a good circulation. This having been determined, an incision about 1.5 in. to the left of the median line and about 2 inches

below the umbilicus, 1.5 or 2 inches in length is made down through the left rectus muscle. A large Payr clamp is inserted through this incision, passed across within the abdomen to the main incision, where it grasps the proximal sigmoid at a point where it has been determined the circulation is good. Another clamp is placed just below except that this clamp is in the main wound. The intestine is then severed with the cautery which is made to heat the blades of the clamp and thus sterilize it before it is drawn out through the wound (Fig. 7). It is pulled well up through the wound with the clamps where it is sutured to the layers of the abdominal wall with fine double chromic catgut placed as a lock suture first sewing the peritoneum to the bowel wall then the aponeurosis and finally a few interrupted sutures hold the skin to the peritoneal surface of the bowel. Usually about an inch of the bowel remains outside the skin.

When this part of the operation is completed a rectal tube which was introduced into the anus by a nurse at the beginning of the operation is now pushed up through the sigmoid to the point near the clamp on the distal gut. A purse string of linen is placed



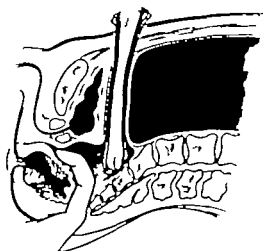


Fig. 11. Fingers flexed on palm, separating rectum from bladder, prostate and urethra.

the devitalized tissues, or inserting a drainage tube through the space between the rectum and the sacrum for the purpose of draining the devitalized area was the first consideration, but experience caused me to decide in favor of the method described.

After the type of cancer with which we have just been dealing, the next most frequent and important cancer of the rectum is moderately advanced cancer located in the ampulla of the rectum of woman. The operation in woman differs from the standard operation just described in two points.

1. When the time comes to place the quarantine a long forceps is passed into the vagina, a hole is made in the posterior fornix through the septum into the cul de sac. Enough wicks to make a roll of gauze an inch or more in diameter is put in the grasp of the forceps and drawn out through the vagina, leaving enough of the wicks inside the cul de sac to turn over the end of the inverted rectum into the hollow of the sacrum and coccyx where it is to form a quarantine and is also to serve the purpose of a drain (Fig. 12). (As above stated this same technique may be applied in the male by bringing the pack or drain out through a stab wound back of the rectum and omitting the drain in front. An objection to this would be a cut both in front and back leaving the patient no com-



Fig. 12. Space from which rectum has been removed, connected with abdominal drainage canal through which irrigation may be conveniently made.

fortable surface on which to lie while no drawback to the technique has been noticed.)

2. The uterus may be turned backward into the hollow of the sacrum and sewed around to the parietal peritoneum for the purpose of making a good abdominal floor and an intact peritoneal cavity (Fig. 13) or it is very easy to use the pelvic peritoneum back of the uterus.

The next cancer of the rectum of most importance is located in the rectosigmoid segment of the gut, in which obstruction is one of the earliest symptoms and in which it is impossible to pass a tube for the inversion of the end of the distal sigmoid (Fig. 14). In this case the steps of this operation are the same as have been related in the standard operation except that the bladder and prostate are separated from the rectum in front (Fig. 5) and the rectum is mobilized on the side as well after which a long clamp grasps the rectum as far below the growth as possible. Another clamp is placed between this clamp and the growth after which the intestine is cut between the two and the severed sigmoid is removed along with the growth and the devitalized fat which has been lifted when mobilizing the rectum (Fig. 16). The handle of the clamp on the remaining rectum is



are to be removed and the normal structures which are to remain. This change makes the second operation a minor affair.

When we are ready for the second operation we still have in place the quarantine especially in man for it is allowed to remain as a landmark in doing the second operation. In woman, where the retroverted uterus has been used to form the floor of the cavity the pack may be removed from the vagina a few days before the second operation in order to get rid of the odor.

The patient, if a man is placed on an operating table which breaks in the middle. He lies on his face with both head and feet lowered in the jack-knife position. Incision is made in the center of the lower part of the sacrum down to within an inch of the anus where it divides and surrounds the anus and all the anal muscles any bleeding skin vessels may be caught with forceps the coccyx and lower end of the sacrum are exposed the last part of the sacrum and coccyx removed with bone forceps the fingers of one hand are introduced between the sacrum and the ischio-rectal fat until the cavity containing the quarantine is reached (Fig. 20). Usually there is a good deal of pus and debris in this cavity which is entirely ignored as harmless. The fingers are then pushed over farther around the end of the inverted rectum and above the growth and the rectum, and all are peeled out with an ease and completeness which is not believable until one has actually had the experience (Fig. 21). The usual time required for the whole operation from the time of the first incision in the skin until the specimen is entirely removed is about 5 minutes without any necessity for hurrying (Fig. 22).

In woman we usually use the Murphy method and split the vaginal mucous membrane and perineum. If the growth is on the posterior wall of the rectum the mucous membrane of the vagina is simply lifted and allowed to remain. If the growth is in the front wall of the rectum the posterior wall of the vagina comes away with the rectum. After this incision in the vaginal wall is made, the fingers of the left hand are passed through the drainage opening, made to curve



Fig. 5 Photograph showing wound on eighteenth day after operation. Patient allowed to be up.

around the inverted rectum follow down past the coccyx and peel out the growth with the rectum and the muscles around the anus (Fig. 23) which are cut as far distal to the growth as possible. Without any hurry this operation has been performed in less than 5 minutes. In no instance is there any bleeding except that around the anus and anal muscles, which requires the use of artery forceps. I have several times found it unnecessary even to use these. I think I am safe in saying that the total loss of blood for both operations would not average more than 4 ounces and at no time are we in danger of any serious loss of blood. The clean cavity left after removal of the rectum in this way is very surprising. Nature for some reason has during this interval made a line of cleavage which is very definite and the fingers, without particular care will follow this line of cleavage. After the rectum is out the vesiculae seminales, vas deferens, and bladder are in plain view practically without bleeding. The cavity along the hollow of the sacrum is almost as smooth as the bone itself.

In case the cancer has been very extensive and has probably penetrated the fascia propria, we use a large dose of radium packed in the gauze. In some cases we have used the radium at the time of the operation and at other times we have used it 4 days later with a second pack of gauze. The radium is applied by using two or three 50 milligram tubes of radium in the ordinary brass containers.





## RECURRENT DISLOCATION OF THE SHOULDER

## WITH REPORT OF CASES

BY W. RUSSELL MACAUSLAND, M.D., BOSTON, MASSACHUSETTS  
Surgeon in Chief, Orthopedic Department, Carney Hospital

**R**ECURRENT dislocation of the humeral head occurs most frequently in early adolescence. It is generally preceded by a history of trauma, the original injury having been sufficient to produce a subglenoid or subcoracoid dislocation of the head. Men are more prone to the affliction than women and it is found more commonly in the relaxed type of individual. Epileptics are particularly subject to it. Only rarely is there a case of double dislocation.

## PATHOLOGY

The pathology varies widely in different individuals.

**Capsule.** The most constant lesion, which may be of several varieties, is located in the capsule. In some cases there is actual avulsion of the capsule from its attachment while in most cases it is raggedly torn, usually in its anterior and inferior parts, and stretched to a point where, even in repair, an actual pouch is found on the inferior and anterior surface. As this portion of the capsule is not supported by muscle it is easy for the head to slip out. The pouch acts as a receptacle for the head, when the patient's arm is abducted or elevated.

Some operators have described a capsular periosteal separation, in which the capsule and a part of the glenoid pad are continuous with the periosteum detached from the scapula.

**Bone.** Chief among the bony abnormalities that have been observed is the defect of the humeral head. Many surgeons since the time of Joessel (35) Cramer (10) and Loebker (43) have demonstrated by resections on both the cadaver and on the living that the humeral head is normal in only its anterior part. A wedge-shaped notch exists on its posterior side which is caused by the striking of the head against the glenoid margin when luxation occurs. Grégoire

(26) considered that this groove in the head was the main cause of recurrent dislocation.

In some cases the lower glenoid margin is found worn off. In others there may be loose bodies or avulsion of the great tuberosity. In some of the severer cases an actual pulling away of the inferior capsular ligament with its bone attachment may take place thus lessening the ridge of the glenoid cavity and making displacement easy.

**Muscle.** Occasionally the muscles supporting the joint and holding the head against the glenoid cavity are found torn or atrophied. The resulting altered muscle tension is undoubtedly connected with dislocation. The pectoralis major, the latissimus dorsi, and the teres major keep the head pressed against the glenoid surface while the supraspinatus, infraspinatus and the teres minor act as the lateral rotators and the subscapulars as the medial rotator. In a posterior dislocation, the detachment or rupture of the subscapulars contributes to the loss of support. In cases in which the insertions of the supraspinatus and infraspinatus are torn off at the first luxation, relaxation and loss of tone result. The teres major and latissimus dorsi then tend to pull the head downward and when the muscles contract the head slips over the glenoid margin.

## SYMPTOMS

The main complaint in all cases is the fear that displacement will occur on abduction of the arm. This fear seriously handicaps the patient in any occupation that involves the possibility of arm elevation and is a serious obstacle in sports.

The frequency of recurrence varies in different cases. Some dislocations recur only once in several months, while others may occur daily. Occupation has much to do with the frequency. Sometimes turning in bed will

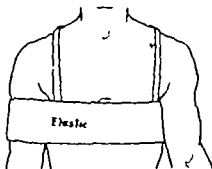


Fig. 1 An elastic surcingle

produce a dislocation. Fortunately cases that have luxated several times may be reduced easily.

Some muscular atrophy of the coracobrachialis, triceps, deltoid and especially the posterior part of the supraspinatus and infraspinatus may be observed. There may be a slight limitation of motion frequently in abduction.

Pain is usually present just after actual displacement.

The diagnosis is made purely on subjective symptoms: voluntary spasm and protection against dislocation on any attempts at abduction, together with the history of recurrent attacks without trauma.

#### CONSERVATIVE TREATMENT

After the initial displacement the shoulder is reduced and held to the side for a period of at least 2 weeks. In recurrent cases an elastic surcingle 3 to 4 inches wide is placed around the chest and over the affected arm several inches below the shoulder. This serves as a constant reminder and resists the abduction of the arm (Fig. 1). The surcingle should be worn constantly for 6 months, and during this time local therapeutic measures: baking and massage should be practised. If only two or three displacements have occurred, this treatment often succeeds.

When displacement has recurred too many times and especially when the displacement recurs only on slight exertion, conservative treatment is of no avail. Operative interference offers the only means of overcoming the difficulty.

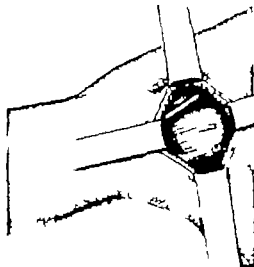


Fig. 2 The 4-inch incision made posterior to the axilla and parallel with the arm

#### OPERATIVE TREATMENT

##### *Usual Two-day Preparation*

The arm is abducted to an angle of 90 degrees with the body. The humeral head is then easily felt as prominent in the axilla. The vessels are located and a 4-inch incision made posterior to them and parallel with the arm (Fig. 2). A plexus of veins is usually found over the head and these are cut and retracted. The subscapular muscle is then exposed directly over the humeral head. It may be retracted as a whole or it may be divided in the direction of its fibers and the portion overhead retracted. The capsule over the head is then in view and a complete exposure of the capsule should be obtained. About halfway between the glenoid and the middle of the humeral head a curved incision is made parallel to the glenoid. After the head is examined and the pathology studied, it is replaced. The capsule is overlapped well and the sutures placed, but not actually tied until the arm is brought down to an angle of about 45 degrees from the body (Fig. 4). Chromic gut is usually used for this purpose. The subscapular muscle is then returned to normal and the skin closed with interrupted catgut No. 1. Dry dressing is applied and the arm held at the side for 6 weeks.

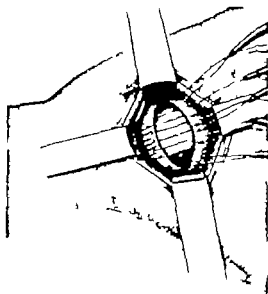


Fig. 3. Capsule overlapped and sutures in place.

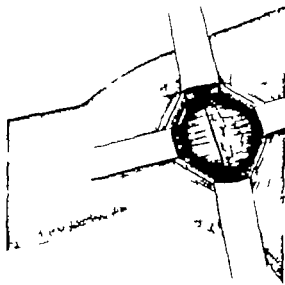


Fig. 4. Capsule overlapped and sutures tied.

without motion. Then restricted use is allowed, taking care to protect the arm from forced abduction for a period of 3 to 4 months (Fig. 2).

#### REPORT OF CASES

**CASE 1.** R. M., an epileptic, suffered from dislocation of both shoulders. When I saw the patient in January, 1901, he reported that the right shoulder was dislocated about twenty times during the previous year. Abduction of the shoulder was limited by spasm. The left shoulder first slipped out 4 years ago and dislocation had recurred about forty times. The left shoulder, as operated on elsewhere twice without relief, and a third operation prevented the shoulder from slipping out again, but resulted in a considerable limitation of motion.

**Treatment.** An operation following the technique described was performed on the right shoulder in March, 1901. Six weeks later the anteroposterior motions were normal and abduction as the half normal.

In June, 1901, 3 months after intervention the patient in falling, displaced the right shoulder anteriorly. Another operation was done in August, 1901. After several falls during epileptic attacks resulting in dislocation an excision of the head of the humerus, as done in September, 1901.

**Result:** In June, 1903, when I examined the patient, abduction of 80 degrees was possible in the left shoulder. Rotation in adduction was normal. Rotation in abduction was possible for a few degrees each way. There had been no recurrence. The patient had wrenched the right shoulder a week before. Abduction without pain as impossible

beyond 50 degrees. A few degrees of internal and external rotation were possible. There was marked atrophy of the deltoid. There had been no recurrence.

**CASE 2.** E. R. dislocated his left shoulder while playing football in 1900. I took him up to the time of admission to the hospital (February, 1901) the shoulder was dislocated fifteen times.

**Treatment.** An open reduction, using the usual technique was performed in 1901.

**Result.** Twelve years later the patient wrote me that he had never had any trouble with the shoulder and he used it as freely as the other one.

**CASE 3.** E. D. dislocated both shoulders while playing football in 1900. When I saw the patient 3 years later the right shoulder gave no symptoms, but the left had slipped out repeatedly since the injury. The shoulder was dislocated eight times during 3 months, once while sleeping.

**Treatment.** An operation following the usual technique was performed in 1905.

**Result.** Up to December, 1901, there was no recurrence nor any disability except a slight weakness in doing heavy physical work. Late in December the shoulder came out once during gymnastic exercises. Up to the present time (June, 1903) there has been no further trouble but the patient uses the arm with caution.

**CASE 4.** E. L. while playing football in 1901 dislocated his left shoulder. Recurrence took place six times after the original dislocation, then during sleep.

**Treatment.** An open operation was done following the usual technique.

**Result.** About 9 months later the patient reported having no trouble, except that the arm was not as strong as the other.

**CASE 5.** S. S. fell from a horse in 1913 and injured her shoulder. Since this injury dislocation had recurred repeatedly once while dancing once while swimming.

**Treatment.** An open operation following my usual technique was done in May 1916.

**Result.** The patient wrote several years after the operation that she had had no trouble with the shoulder although at times it felt weak. She is convalescing in camp.

**CASE 6.** L. R. while resting, dislocated his left shoulder and 6 months later the shoulder came out again. Before 1912 the patient in 1915, dislocation had recurred fifteen times.

**Treatment.** An open operation was done in which the capsule was quilted.

**Result.** Three years after the intervention, the patient showed perfect result and the arm had never given him any trouble.

### HISTORY

Prior to capsulorrhaphy braces and bandages were first used in treatment but as they allowed only limited motion they were finally disregarded.

Hippocrates (32) tried to form a cicatrix to contract the joint space by entering the articular cavity with a red hot iron. Malgaigne (46) and others practised myotomy in the hope of producing an inflammatory condition.

Albert (2) in 1879 first tried arthrodesis. He was followed by Wolff (84) Karszewski (36) Mueller (50) and others. Cramer (10) in 1882 made a complete resection of the humeral head. There were many imitators of his technique particularly in Germany.

But all these methods were finally abandoned because they resulted in diminution of function or were considered unsurgical.

**Capsulorrhaphy without arthrodesis.** In opening the joint for resection, the dilated condition of the capsule attracted the attention of the operators. Several methods, with or without arthrotomy or capsulotomy were then devised to obtain a diminution of the capsule. Ricard (59) in 1892 first tried capsule reefing without opening the joint by forming a permanent fold in the anterior portion of the capsule by means of three silk sutures placed vertically. No relapse followed and normal mobility resulted in two cases.

Many surgeons followed his technique or modifications of it. Certain operators used a

posterior incision instead of the anterior one. Steinthal (74) Paladini (54) Mueller (50) Francke (22) Payr (55) Lardennois (41) Nelson (31) and Thomas (76) operated in a similar manner.

Dehner (13) and Krumm (39) used a posterior vertical incision to bring the humeral head to the posterior cavity rim and then contracted the capsule at about the approach of the head into the rim.

Beck (5) in 1903 plicated the capsule on its anterior surface and in addition carried a silver wire through a hole drilled in the head of the humerus and in the acromion. The wire was removed in 5 weeks. The result was perfect.

Macleaire (47) and Berger (6) modified the method. Berger by fixing the capsule to the tip of the acromion to reinforce it, and Macleaire by making two plications, one vertical and one horizontal.

Trethowan (77) successfully plicated the capsule in a case but he found the operation very difficult.

Picquet's (57) method differed from Ricard in that he formed a fibrous uniaxial capsulorrhaphy on the anterior face of the joint by passing three sutures of horsehair or silk through the capsule. He discriminated between the cases in which there was a swelling of the capsule and those in which there was a notch in the humeral head and a capsular periosteal separation. In the latter cases, resection followed capsulorrhaphy. De Fourmestraux (21) made the same discrimination.

Legueu (42) relieved an epileptic patient by reefing the capsule with horsehair. Three months after the operation, the patient fell, causing a new luxation. Picquet (57) used his method on the case and obtained a successful result.

Blas (7) in 1906 tightened the capsule in a case in which there had been fifty recurrences, by means of including an elliptical portion in silk strand sutures. A perfect result was obtained.

In 1908, Silmsen (75) used Ricard's method successfully making a permanent fold by means of three silk sutures placed vertically. Meyer (48) used the same procedure in one case.

The same year Dahlgren (11) traced the efficacy of simple capsule contraction and found there had been no relapse in twenty five of the forty one cases which he collected from literature. All of these cases had not been due to the enlargement of the capsule but to other causes such as the tearing off of the muscles especially the outward rotators.

Wilmanns (82) had two interesting cases in which he obtained perfect cures through simple interference and contracture.

Kosloff (37) herself suffered from a recurrent dislocation of the shoulder. She was operated on by Duval who sutured the capsule vertically with linen thread. The patient, after 4 years, used the arm with the same facility as the sound one. Kosloff believed capsulorrhaphy was justified in cases where, aside from the laceration of the capsule there existed a capsular tear, a capsular periosseal separation, or a lesion of the anterior edge of the glenoid.

Walther (78) in 1918 plicated the capsule by means of three horsehair sutures passed from the inner side outward through the entire length of the capsule. His patient could pursue his occupation although there was some limitation of motion.

Rivière (61) secured a perfect result by returning the capsule and fixing it to the scapularis without opening the joint.

Durand (17) in 1919 reported a case in which he made a vertical and horizontal fold in the capsule. No relapse followed and the patient had normal motion.

*Capsulorrhaphy following arthrotomy.* As these methods did not permit the exploration of the joint, which several surgeons believed to be important, Samter (64) and Mikulicz (49) then recommended the splitting of the capsule vertically and the drawing of the medial part over the lateral part.

Grothe (37) incised the anterior portion of the capsule and narrowed it by overlapping the edges of the incision.

MacKinnon (45) in 1907 in the case of a farmer whose shoulder dislocated frequently in sleep, introduced mattress sutures into one margin of the incised capsule and tied the sides in such a way that one flap came under the other. The patient made a complete recovery.

In discussion of this report, Dr Wright said he had successfully quilted the capsule transversely in the case of an epileptic patient.

Steeg (73) in 1910 reported a case in which, after exploration of the joint, he introduced four sutures of catgut vertically into the capsule. The result was successful; the patient had full function of his arm.

Schultze (67) in his operation, after blunt dissection of the deltoid on the outside, freed the capsule and drew the edges of the wound one over the other. In this way he doubled the anterior capsule.

Worcester (85) overlapped the edges of the capsule in three patients, with successful results.

Henderson (29) in 1921 issued a report of nineteen cases treated in the Mayo Clinic. The method used was based on the principle that the anterior inferior portion of the capsule is torn and as this portion is unsupported by muscular insertions recurrence is easy. Therefore this section of the capsule was strengthened. In some cases the pectoralis major was lengthened. The condition of sixteen patients was decidedly improved, 50 per cent of these were cured. It was too early to report on the other three cases.

Of a group of eight patients on whom he reported in 1917 one had dislocation nearly 6 years after the operation and another patient had relapse in 5 years. Both however were better than before the operation.

Dresemann (15) Goldmann (25) Wilmanns (82) Samosch (63) Hildebrand (31) and Schultze (67) tried capsule doubling or reinforcing. Wiesinger (81) used the incision of the capsule and tamponade to secure reduction.

*Capsulorrhaphy after excision.* The first capsulorrhaphy after excision was tried by Genster (23) in 1883. He removed a piece of capsule by a semi-elliptical incision and united the capsular wall as well as the muscles and skin, by three tiers of interrupted catgut. The patient was cured.

Bardenheuer (4) in 1886 excised two pieces of capsule and secured good results.

In 1895 Burrell and Lovett (8) removed an elliptical piece and sutured the capsule to

shorten it. A second case was reported in 1897. They believed it important to divide the tendon of the insertion of the pectoralis major for three-fourths its breadth to allow uncovering the capsule.

Warren (79) Dawson (12) Baldwin (1) and Albee (1) secured good results using Burrell and Lovett's procedure.

Mueller (38) Haegler (28) Kuh (40) Kronacher (38) Goldmann (25) and Donald (14) reported cases in which they excised pieces of the capsule. Some surgeons combined the methods of Gerster and Mikulicz.

Between 1909 and 1921 Thomas (76) used several reports summarizing his cases and describing his technique. The capsule was contracted by sutures, by overlapping or by excision. At first he used an anterior axillary incision but later recommended the posterior route as he found the capsule could be approached more easily in this way. Also the wound was smaller and motion returned more rapidly. In the cases in which the method of excision was employed Thomas allowed cicatrization across the gap made in the capsule then contracted the portion in within normal length and stretched it by suitable exercises. In all cases he found evidence of wearing in the posterior part of the head and glenoid. In some it was necessary to do a partial excision of the head.

Because of the wearing which will prevent complete return of the joint to normal Thomas considered the terms of success only relative. In 1921 he based a report covering the accumulation of 4 years observations. Of forty four shoulders which he had treated, eighteen had been epileptic cases. There had been no dislocation in eleven cases after capsulorrhaphy done in the most recent case 4 years before the time of the report and in the first case 11½ years before. Another case had been successful after evulsion of part of the humeral head. Three were failures. In the non-epileptic group, there were twenty two successful cases after capsulorrhaphy done in the first case 13 years before and in the last case 3 months before. There were two failures.

*Capsulorrhaphy Plus treatment of other lesions.* Some surgeons did not consider

capsulorrhaphy sufficient as they found other lesions present and believed it necessary to do a simultaneous operation to give the joint support.

Winiwater (83) in 1905 presented a young man on whom he had operated 2 years before. One incision was made along the upper edge of the clavicle and a second made obliquely between the major pectoralis and the deltoid muscle. Two folds were made in the capsule by means of sutures. Then to oppose dislocation of the head he united the upper edge of the subscapularis to the lower edge of the minor pectoralis by a series of sutures, thus stretching the two muscles over the capsule. The major pectoralis was returned to its place and sutured at its clavicular and deltoid insertion. The functional result was excellent. In 4 months the patient had complete use of his arm.

Other surgeons strengthened the capsule by nailing the head of the biceps on the lesser tuberosity to strengthen the restraining apparatus in front of the joint. Wendorf (86) used this method in connection with capsular plication.

Sekel (68) in 1913 reported a case in which he separated the subscapularis muscle took out an oval piece of capsule and sutured the edges of the capsule together. He then covered the entire front of the joint with a piece of transplanted fascia and sutured it to the deltoid and subscapularis. The patient died some time later and examination showed the flap had been preserved. Payr (55) also reported one case using this technique. Schulze (67) was of the opinion the fascia flap was necessary.

Still others reduced the capsule and sutured the outward rotators. These operations treating the muscles are chaotic. Mueller (50) tried to revise the external rotators at their appendage behind the deltoid or subscapularis.

Pertbes (56) twice used reefing of the capsule and firm fixing of the torn external rotators on the great tuberosity. In the four cases reported, he varied his technique, according as the muscles were torn, the cavity rim broken or the capsule dilated. If the muscles were torn from the tuberculum majus, he

replaced their insertions on the head of the humerus by means of V shaped nails. The tendons were nailed directly to the bony surface or attached to the bows of the nails with silk. If the glenoid rim was torn it also could be fixed by means of V shaped nails driven into the neck of the scapula.

Hildebrand's (31) operation was concerned with the changes of the joint cartilage. He deepened the cavity with a sharp curette and thus obtained a prominence of the medial glenoid edge.

Besides capsulorrhaphy other methods were tried, some to change the tension of the dilated capsule or others to construct a ligament to hold the joint in place.

Roeple (62) reefed the tendon of the subscapularis muscle to secure better support around the capsule. This was handled by an incision on the outside axillary border. Selig (69) proposed reefing the supraspinatus tendon as he considered this muscle played an important part in dislocation. Sever (71) recommended suturing the subscapularis tendon and dividing the pectoralis major tendon. Capsulorrhaphy may be performed in connection with these steps but it is not necessary. Complete revision of the pectoralis major was done in forty cases. There were no relapses or loss of motion.

Joseph (34) used fascia lata strips to construct a ligament that would prevent luxation of the head. In two cases, the results were satisfactory and motion, which he had feared might be lost, was good. Schmieden (66) also secured a favorable result by this method.

Semken (70) made a vertical incision 1 inch external to the anterior border of the deltoid. A tunnel was made under the subscapularis and a graft of fascia lata from the thigh drawn through and its upper end fastened with interrupted catgut sutures to the upper part of the capsule and its lower end to the subscapular head of the triceps muscle. This flap thickened and contracted and hindered the anterior excursion of the humeral head.

Loeffler (44) Sanders (65) and Herforth (30) advocated fascia flaps to gain security. Platt (19) recommended a silk cord to connect the humerus and the axillary border of the scapula.

*Treatment of muscular contraction.* Several surgeons believe that operation should be directed to the relief of the disturbance of the co-ordination in the muscular contraction. At the surgical congress in Germany in 1909 Clairmont and Ehrlich (9) proposed a new method—myoplasty—to struggle against the action of the deltoid. The opposing muscular traction was obtained through the formation of a flap on the inner portion of the deltoid muscle which was passed from behind forward under the neck of the humerus and its end sutured to the same muscle in front. This flap acted as a sling to hold the joint in place.

Clairmont reported four cases. Major Dunn (16) one case. Platt (58) one case and Thomas (76) three cases. Only one of these cases (Clairmont's) relapsed. Seven cases by Gibson (24) gave favorable results.

R. Jones (33) in 1912 is reported to have done two of these operations. The flap was carried through the quadrilateral axillary space and fastened to make a sphincterlike ring about the neck of the humerus. Immobility for 3 months followed. One case recurred from lack of immobility or insufficient fixation of the muscle. The second case was a success.

Finsterer (20) secured satisfactory results in seven cases, using muscle flaps. O'Brien Shaw (52) advocated this procedure.

Other surgeons attempted the division of the tendon of the subscapularis muscle. Spencer (72) reported one successful case and Openshaw (53) three satisfactory cases.

Another type of operation was based on changing the leverage of the two powerful muscles which act as the dislocating force. Young (86) was the advocator of this method, which was suggested by Allis. The incision was made in the space between the deltoid and pectoralis major muscles. The attachment of the latter muscle was divided at its lower half. Through a second incision the latissimus dorsi muscle was reached and the lower half divided. The arm was put in wide abduction for 10 days.

Eden (18) found that in many cases the tearing of the capsule with bone from the cavity rim was ground for the return of the



luxation. In these cases, he considered that capsule reefing suturing of the external rotators or muscle plastic could not prevent recurrence. The joint capsule must be fastened into position and the shape of the cavity restored. This was obtained by building a hindrance of a piece of bone from the tibia. The torn capsule was fastened in its old place by sutures. Two patients have had no relapse after 3 years.

## CONCLUSION

From a study of the literature of this subject it appears that the treatment of recurrent dislocation of the shoulder has been one of varying technique. No consistent method adaptable to a large number of cases has been reported. On the contrary each treatment differs according to the importance attributed by the surgeon to the pathological condition of the bone capsule and muscle. The majority of cases have been treated by some form of capsulorrhaphy and in most of them satisfactory result have been obtained.

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## EXTRAPLEURAL THORACOPLASTY IN THE TREATMENT OF BRONCHIECTASIS<sup>1</sup>

By CARL A. HEDBLOM, M.D., F.A.C.S., ROCHESTER, MINNESOTA  
 Section on General and Thoracic Surgery, Mayo Clinic

**B**RONCHIECTASIS is a disease of the bronchi. Pathologically it is characterized by inflammation resulting in a primary thickening, then a destructive thinning and stretching of the bronchial walls. The cavitations so produced may be cylindrical, spherical or saccular. The surrounding lung parenchyma is probably always involved in the inflammatory process. A special men may show an extensive cirrhosis alone or secondary areas of acute suppurative pneumonia or multiple abscesses (Fig. 1). Solitary abscess cavities may form by ulcerative perforation of the bronchial walls. Bronchiectasis may be localized or diffuse, unilateral, or bilateral. In a series of 416 cases 36 per cent were unilateral, 28 per cent bilateral, and in 36 per cent the distribution was uncertain. Unilateral cases only are suitable for surgical treatment and the determination as to location and extent of involvement may be very difficult.

With the exception of the rare true congenital type the disease is always of infectious origin. It occurs as a sequel to pneumonia especially when complicating pertussis and the exanthemas, following bronchopneumonia particularly of the hemolytic streptococcus type, and as a late sequel to septic infarcts often wrongly diagnosed postoperative pneu-

monia. It also occurs from primary infection of a bronchus by inhaled foreign body or septic material in childhood, and during or following operation under general anesthesia. Probably a large proportion of the cases of uncertain origin and of the so-called congenital type beginning in early childhood are due to foreign body infection.

The disease is characterized chiefly by periodic paroxysmal cough with evacuation of large amounts of purulent sputum and in varying degree by fever, leucocytosis, anemia, weight loss, night sweats, and hemoptysis. In this series of 416 cases hemoptysis was present in 26 per cent. The condition of many of these patients, some with foreign body in a bronchus, had been diagnosed tuberculous and treated for months in tuberculosis sanitariums.

The physical signs may be those characteristic of consolidation or cavitation or may be so slight that no conclusions can be drawn from them either as to the presence or localization of the lesion.

Röntgenograms may show streaky shadows due to increased density along the bronchial walls, a dense basal shadow due to a localized bronchiectasis (Fig. 2), abscess with associated bronchiectasis (Fig. 3), scattered circumscribed areas of increased density



Fig. 3 Multiple pulmonary abscesses and bronchiectasis (Case 1990-13)

due to pneumonitis or multiple discrete abscesses, or a dense diffuse shadow produced by a thickened pleura making the lung condition (Fig. 4). The roentgenograms revealed entirely normal conditions in 15 per cent of the cases in this series.

Diagnosis depends chiefly on the presence of paroxysmal cough with evacuation of large amounts of sputum and by the exclusion of pulmonary tuberculous abscess and empyema with bronchial fistula. One important sign to which Lemon has directed attention, is the ability of the patient to produce sputum at will by assuming a head down position.

Medical treatment of bronchiectases has been palliative only. Surgical treatment has been limited to a small minority of patients and only a few isolated patients have been cured. Among surgical methods that have been attempted are drainage, pneumothorax, extrapleural collapse and lobectomy. That drainage would prove useless in cases of



Fig. 4 Localized bronchiectasis proved by operation (Case 1893-8)

diffuse bronchiectasis could have been predicted from a consideration of the pathological anatomy. It was found to be not only useless but highly dangerous. In individual series the mortality reached 78.6 per cent (Table I). Pneumothorax has proved a safe procedure but of only temporary benefit in the cases so far reported. Extrapleural thoracoplasty was tried many years ago and condemned. Brauer is quoted as having said that he had never observed nor seen reported in the literature a case of bronchiectasis cured by thoracoplasty. The relatively poor result may probably be ascribed to an operation not sufficiently extensive to secure collapse of the diseased portion of the lung, and the high mortality to too much being attempted at one time. Lobectomy was heralded as the operation of choice particularly after the development of differential pressure anesthesia designed to obviate the dangers of open pneumothorax. The expectations have however not been realized and the operation seems so far not to be justified by its results. In 58 cases reported in the

TABLE I—RESULTS OF SURGICAL TREATMENT

Operation	Cd. local cases	Per cent cured	Per cent im- proved	Per cent not im- proved	Per cent dies
Lobectomy	1	11		87	1
Thoracoplasty	5	20		80	84
Pneumothorax	1		75	25	
Act. of local disease shortly	5	19	66	15	
Pneumothorax	15	27			1

\* Per cent of 28 cases in which operation was performed



Fig. 3. Roentgenogram of chest in same case as shown in Figure 2. Multiple abscesses and bronchiectasis. (Case 159015)



Fig. 4. In this case pulmonary suppuration with secondary pleuritis as masking the lung shadow. (Case A383008)

literature 30 patients died following operation an operative mortality of 52 per cent. Furthermore in only 17 per cent of the 48 cases studied by Graham as to end results was a cure achieved. The operation according to its most enthusiastic advocates is suitable only for selected patients, leaving out of consideration the large majority who are in greatest need of relief.

In considering, in the light of these results what could be done for these patients who continually confront us it seemed to me that thoracoplasty deserved further trial. A partial thoracoplasty has yielded encouraging results in the treatment of unilateral pulmonary tuberculosis. It seemed to me that by making the collapse more complete improvement might reasonably be expected also in bronchiectasis and by bringing about the collapse in stages the operative mortality might be reduced. In cases in which relief of symptoms did not follow lobectomy could then be attempted seemingly with less risk. Accordingly I performed an extensive graded thoracoplasty on two patients both having generalized unilateral involvement of lung

standing and raising from 500 to 1000 cubic centimeters of purulent sputum in 24 hours. Both patients improved so markedly that indications for such a hazardous operation as lobectomy were entirely set aside. I then adopted an extensive extrapleural thoracoplasty as a tentative routine procedure. The results to date have exceeded expectations. All patients with bronchiectasis so far operated on have been improved to a greater or lesser degree and none has died.

The operation which I have evolved consists of the subperiosteal resection of the whole length of the third or fourth to the eleventh ribs inclusive in six stages under combined local nerve block and gas or oxygen anesthesia (Fig. 5). The object of the resection is to secure permanent collapse of the diseased portion of the lung. The ribs are resected subperiosteally because by so doing there is less risk of penetrating into the pleural cavity. The pleurae are often of normal thickness and not adherent so that a pneumothorax would follow tearing of the parietal pleura and this would probably add materially to the operative risk and to the danger of



Fig. 5 a.



Fig. 5 b.



Fig. 6

Fig. 5 a. b. Anterior lateral and anterior views. Note because of deformity and good function of arm. Whole length of the third to the seventh ribs inclusive was resected. Complete symptomatic cure. (Case 1390997.)

Fig. 6. The dark line shows location of anastomosis which followed the injection of the nerves with alcohol, about 3 months after the nerve trunks were injected. (Case 1496477.)

secondary emphysema. A partial regeneration of rib also protects the collapsed lung.

A posterior resection is performed first because it produces the greatest relative amount of collapse of the chest wall and because it affords access to the proximal portion of the intercostal nerves (Fig. 7). These nerves are injected with 95 per cent alcohol which produces an anesthesia which lasts for many weeks. A relatively painless postoperative course is thereby obtained which is of great importance when a series of five or six operations is to be performed (Fig. 6). A painful postoperative course is apt to destroy the patient's morale. Such prolonged anesthesia also makes possible the painless resection of the anterior and lateral segments. Cutting the nerves is objectionable because it produces permanent anesthesia and results in paralysis of the abdominal muscles.

Eight to ten centimeter segments of the anterior extremities are next resected to the costochondral juncture. The remaining lateral segments may be reached by a straight incision in the axillary line which avoids cutting any of the muscles except the serratus. The

posterior lateral and anterior resections are performed usually each in two sittings. The wound is closed in layers, a small drain being placed and removed in 24 hours. The different stages are performed at intervals of about 7 days, the patient sitting up often on the day following the operation. The postoperative course is usually relatively painless. One feature of paramount importance in the postoperative management is the gravity evacuation of bronchial secretions at regular intervals of from 3 to 4 hours beginning immediately after operation. One patient developed a sudden attack simulating pulmonary edema, became exceedingly cyanosed and comatose.

TABLE II.—ETIOLOGY

Tuberculosis
Pyrexemia
Bronchitis
Emphysema with bronchial fistula
Toxic infection (ether anesthesia)
Appendicitis
Posterior gastro-enterostomy
Liver body in bronchus
Whooping cough
Compensation

Case  
I

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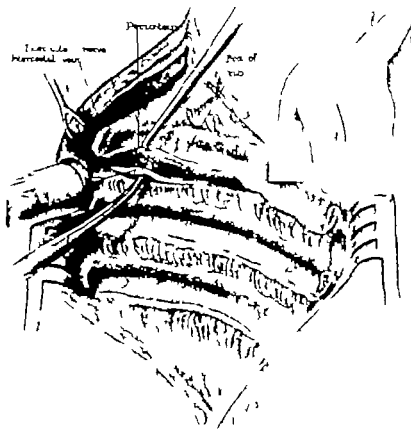


Fig. 7. Injecting 0.5 per cent alcohol into the nerve trunk close to its origin at the head of the rib.

and would have died from drowning in her own secretions had she not been promptly inverted into a head down position.

During the last 3 years I have performed a graded extrapleural thoracoplasty on 18 patients with bronchiectasis. In several the initial lesion was most probably a pulmonary abscess, but at the time of examination the findings were essentially those of bronchiectasis. Eleven of the patients were males and seven were females. Seven patients were between 15 and 20 years, seven between 21 and 30, two between 31 and 40 and two between 41 and 50 (Table II).

The cases of influenza all occurred during the period of the epidemic, which fact points to a hemolytic streptococcus infection. In those following pneumonia the infection was of the recurrent type; in one there had been five attacks. In both cases that followed

tonsillectomy the early history was that of pulmonary abscess but all the findings at the time of examination years later were those of bronchiectasis. The patient whose pulmonary symptoms followed appendectomy finally developed bilateral abscesses of the chest wall, due to actinomycosis infection. The primary condition was probably actinomycotic bronchiectasis. The foreign body in one instance was a carpet tack, which had been present 7 years before being coughed up, and the other was a head of wheat at least partially coughed up 18 years ago. In two cases the onset of symptoms dated from early childhood. These may have been cases of unrecognized aspiration of a foreign body.

It was difficult to determine the amount of sputum evacuated in 24 hours with any degree of accuracy. In many cases there was a history of considerable fluctuation during

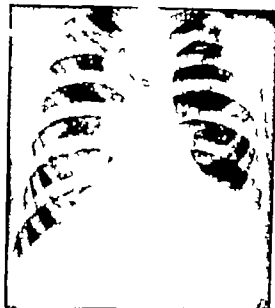


Fig. 8 Before operation. Practically complete symptomatic cure (Case A4 77)



Fig. 9 Bronchiectasis After operation (Case A42 77)

periods of weeks or months. During observation at the Clinic the average amount was from 100 to 250 cubic centimeters in 5 cases, from 250 to 500 cubic centimeters in 10 and from 500 to 1000 cubic centimeters in 3.

The sputum was more or less foul in all cases. Haemoptysis in varying amounts was present in 11. Many of the patients had been treated in sanitariums for tuberculosis for prolonged periods, the erroneous diagnosis of pulmonary tuberculosis having been made apparently largely because of the history of haemoptysis.

#### RESULTS

There was no postoperative mortality and, up to the time of recent reports, no deaths. There were no serious postoperative complications, no marked deformity and no loss of function of arm and shoulder. No patient refused to continue with the series of operations because of the pain or loss of morale. On the contrary several became impatient when for any reason an operation was postponed beyond the appointed time (Figs. 8 and 9).

Seven cases in which the thoracoplasty was not completed 6 months ago are excluded in the study of the results to date. Eleven pa-

tients have been under observation from 6 months to 3 years. The duration of symptoms in these cases was from  $2\frac{1}{2}$  to 20 years, the sputum averaging from 250 to 1000 cubic centimeters. The decrease in sputum has averaged 75 to 100 per cent. Three patients have had only attacks of cough and sputum with haemoptysis in one of these and two have had practically no cough and no sputum. With the one exception of the patient with the actinomycosis, all show gain in weight and lasting improvement in general condition.

#### COMMENT

While massive collapse of the lung has been achieved with marked relief of symptoms in all of these cases, it must be recognized that the diseased bronchi and lung tissue remains as a possible source of further acute exacerbation of infection. The persistence of cough and sputum may be due to an unrecognized involvement on the other side but in some cases reported there are physical and roentgenological signs of persistent cavitation in the collapsed lung. If the symptoms persist, excision of the diseased tissue, either by resection or by cauterization is contemplated.

ADENOMYOMA OF THE RECTOVAGINAL SEPTUM<sup>1</sup>

BY MARK T. GOLDSTINE, M.D. F.A.C.S. CHICAGO

Weisk Memorial Hospital

AND

SAMUEL J. FOGELSON, M.D. CHICAGO

Assistant in Gynecology

FOR many years it has been a recognized fact that epithelium resembling uterine epithelium may be found in other pelvic organs and on other pelvic or abdominal viscera outside of the uterus. The etiology of this epithelium is one of the most interesting problems in gynecology; the chief theories being as follows:

1. Von Recklinghausen believes them embryonic remnants, i.e. structures derived from the mesonephric tubules and duct (wolfian body and duct). The reasons for this belief are that there are found both in adenomyomata and in the wolffian body (a) narrow straight canals with ciliated epithelium—the collecting tubules of the mesonephros (b) wide tortuous tubes with cuboidal epithelium—the secreting tubules (c) distention tubules and (d) fusion of many tubules to form a collecting tubule giving a similar arrangement to the parovarium.

2. Kosman states that adenomyomata arise from accessory müllerian ducts.

3. Cullen believes that they arise from the mucous membrane of the uterus and could prove in all his cases of adenomyoma of the uterus at some place in one of serial sections a definite outgrowth of uterine mucosa toward the adenomyoma. Of the rectovaginal septum, he says "We know nothing as to the origin of these tumors but it is certain that their glandular elements are identical with those of the mucosa of the body of the uterus."

4. Von Franqué and R. Meyer say that adenomyoma is the result of previous inflammation with ultimate pinching off of the newly formed mucosa or gland structure. In all cases there must be (a) injury (b) regeneration (c) infiltrative growth of epithelium producing epithelial structure. In other words, the source of this apparent misplaced epithelium is the overlying epithelium which has been injured and in the reparative process

the glands have resulted. Proof for this is the finding of fragments of elastic tissue and the presence of mast and plasma cells in the center of the mass. When asked to account for decidual metaplasia (transformation) R. Meyer shows that this is not specific for müllerian tissue from which the uterus is derived but does occur in peritoneal adhesions, on the appendix, on the omentum on the ovary and elsewhere.

Further proof is that the following authors have demonstrated epithelial heterotopia as the result of inflammation: (1) Orth, in suppurating follicles of amoebic dysentery, (2) Ziegler in similar regeneration of epithelial growth in bowel abscess and (3) Richter in ileocecal tuberculous ulcer. Therefore any epithelial structure can have the function of heterotopia.

5. Sampson says that adenomyomata are the result of regurgitation of endometrial tissue through the patent fallopian tubes during menstruation with and occasionally without implantation on the ovaries which are usually the intermediate host prior to further transplantation and growth elsewhere in the pelvis and abdomen.

The following cases have come under our observation:

CASE. Mrs. E. age 35, married 7 years, widow 6 months, three children, youngest 18 months, deliveries normal, puerperiums normal, no miscarriages, menstruation began at the age of 18, was of the 8 day type, it was usually profuse and lasted 7 to 8 days, it had decreased somewhat since marriage.

Her present complaints were severe backache, bearing down pains in pelvis, and return of menstrual profuseness to pre-marriage state.

Pelvic examination showed relaxed vaginal outlet and canal, cervix normal, uterus slightly larger than normal, horizontal in position with small degree of prolapse, appendages apparently normal. Some tenderness in cul-de sac of Douglas on firm pressure.

Rectal examination: Lying high in the pelvis, posterior to the cervix, an indefinite nodule could be



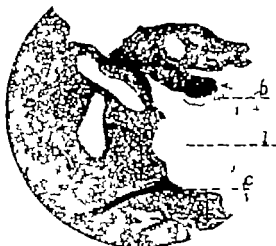


Fig. Case. Photomicrograph (X70) showing part of large cyst lined with single layer of columnar epithelium of endometrial type. c, Cyst wall; g, small gland; b, blood; l, cyst lumen.

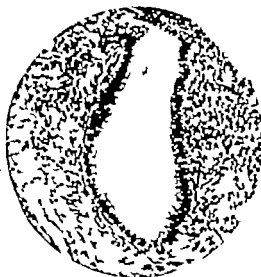


Fig. Case. Photomicrograph (X190) of small gland shown in Figure with typical columnar epithelium of endometrial type actively functioning and stroma of connective tissue and smooth fibers.

palpated, which moved away from the examining finger and which could not be more sharply outlined even with combined abdominal and rectal examination except under anesthesia when it could be sharply outlined.

**Diagnosis.** Adenomyoma of the rectovaginal septum.

**Operative findings.** Abdominal section. There were no abdominal or pelvic adhesions, the uterus was normal and in horizontal position. The tubes and ovaries were normal, but a soft cystic mass about 4 centimeters in diameter freely movable under the peritoneum, could be felt in the rectovaginal septum. The peritoneum was incised and the tumor exposed about 5 centimeters from the cervix. The growth was easily shelled out of the peritoneal incision which was a little larger than absolutely necessary so as to avoid opening the cyst. Very little hemorrhage attended its removal and there was no apparent connection with the cervix, nor was there any damage to the rectal wall.

Macroscopically the tumor showed a cystic growth 3 centimeters in diameter which on section revealed a definite round cyst filled with the typical chocolate colored fluid found in the chocolate cysts of the ovary, about a dram of fluid escaped together with a small clot of old blood. The cyst wall was smooth, dark gray in color, 35 centimeter thick and firmly adherent to the adjacent stroma.

Microscopic examination shows a large cyst made of a single layer of columnar epithelium of endometrial type, with large cigar-shaped nuclei in the base of these columnar cells. There is definite blood pig-

ment and necrobiotic red blood cells in the lumen of these cysts. There are a few smaller similar cysts or glands scattered irregularly around these major cysts. Surrounding these glands there is stroma of connective tissue and muscle fibers arranged in irregular whorls. There are no round cells or other signs of inflammation present in the hematoxylin and eosin stained section. In those sections stained with methyl green pyronin, plasma and mast cells are seen profusely scattered throughout the tissue.

We have in this case an adenomyoma of the rectovaginal septum containing a typical hematomatoma or chocolate cyst of the endometrial type. There was apparently no connection with the uterus, the growth was some distance from the cervix and not adherent to it, nor was the rectovaginal septum obliterated. The uterus was not removed so we had no opportunity of sectioning it, but there were no palpable fibroids. With the pelvic organs normal, no cysts of the ovaries, and with the peritoneum over the tumor smooth, shiny and unbroken, we feel we can exclude the possibility of this being a growth of transplanted endometrial tissue from the uterus primarily or secondarily from an intermediate host, the ovary. The epithelial lining of the cyst resembles that of the uterus near the internal os.

bet there is no mucosal stroma such as is normally found in the endometrium. These adenomata of endometrial type, however, were still functioning or had done so for some time as evidenced by the finding of blood and bloody fluid in the cyst.

**Case 2:** Mrs H, age 7, had been married months, and as never pregnant, menstruation began at 4 years, it was of the 23-day type, profuse for first 2 days and scanty for 3 days. She had some dysmenorrhea, and had had leucorrhoea since girlhood but it was more pronounced since marriage.

The present complaints were marked dyspareunia and constant severe pain in the vagina which was relieved by warm douches.

Pelvic examination: Vulva and vagina were negative except for a but odorless discharge. The cervix as normal in size, shape, and position. There were no erosions or lacerations. There was a marked rigidity posterior to the cervix and pressure caused severe pain. Bimanual examination as difficult owing to marked tenderness over low abdomen, but we were able to map out a large mass on the left side, the fundus of the uterus was not palpable but pressure on above mass as transmitted to the cervix and anterior fornix. No mass could be determined on the right side.

Rectal examination: A large tender mass was palpated posteriorly and intimately connected with the cervix, firmly fixed and adherent to the rectum.

Laboratory examinations: Repeated smears were negative for gonococci, blood Wassermann was negative and there was leucocytosis of 700.



Fig. 3. Case 1. Photomicrograph (X 1) of specimen removed in Case 1 showing distinct cyst formation.

**Pre-operative diagnosis:** Adenomyoma of rectovaginal septum and left ovarian cyst.

**Operation:** Abdominal section. No testicular adhesions were found and the abdomen was negative. Pelvis: The right ovary and tube are normal, the left ovary was cystic, about 2 centimeters long and 5 centimeters diameter, firmly adherent to the rectum at level of internal os and to the posterior uterine wall. The uterus as normal in size and position, but the cervix was fixed by rectal adhesions.

The left ovary was separated from the uterus and rectum with difficulty and as is usual in these cases it was ruptured, the process about 2 ounces of dark chocolate colored fluid escaped. The rectovaginal septum was obliterated and the rectum densely adherent to the cervix a little above the internal os. There were also several organized blood clots in the ovary where the fluid had escaped.



Fig. 4. Case 2. Photomicrograph (X 95) showing adenomata of endometrial type in ovary made of glands of single layer columnar cells. Ovarian stroma, g. glands.



Fig. 5. Case 2. Photomicrograph (X 50) showing in better detail glands of endometrial type of single layer columnar cells. B. Blood. ovarian stroma, g. glands.



Fig 6 Case Photomicrograph (X95) showing adenomyoma of rectovaginal septum. In this case the rectovaginal septum was obliterated and the rectum adherent to the cervix. Stroma, *g*, glands.



Fig 7 Case Photomicrograph (X275) showing in detail single layer columnar glands of adenomyoma with stroma of comparatively old connective tissue with little muscle fiber. Stroma.

The microscopic findings were. In this section of the ovary there are several glands made of single layers of columnar epithelial cells (of endometrial type), with large cigar shaped nuclei in their bases, and the lumen of these glands contains red blood cells and blood pigment. There is profuse hemorrhage throughout the ovarian stroma which is most marked beneath the stratum germinale and an unusually large number of large endothelial phagocytes some of which are full of red blood cells.

The tissue taken from the rectovaginal septum also shows several glands which are also made of single layers of columnar epithelial cells and embedded in stroma consisting of mature connective tissue with little muscle fiber. This tissue is undoubtedly much older than the stroma surrounding the adenomatous structures in the ovary.

We have in this case the macroscopical and microscopical picture of hematomata or chocolate cyst of the ovary of the endometrial type associated with an adenomyoma of the rectovaginal septum. The origin of this interesting pathology is rather difficult to explain because with some reservations it can be placed in any of the etiological groups previously mentioned. The physical, operative, and microscopic findings show definite inflammatory changes. The adenomyoma invaded the uterine wall but did not penetrate to the mucosa. Clinically there were no symptoms

of involvement of the endometrium. When we consider the chocolate cyst of the ovary densely adherent to the adenomyoma, with the endometrial adenomata in the ovary the type involved is apparently that explained by Sampson's theory i.e. that the adenomyoma was transplanted endometrial tissue with the ovary acting as the intermediate host. We would feel that Sampson's theory was conclusive for this case except for two facts: first, we found endometrial type tissue deep in the normal ovarian stroma; and second, the stroma surrounding the adenomyoma of the rectovaginal septum was much older than that of the ovary. May we not then be justified in concluding that the adenomyoma of the rectovaginal septum and the endometrial adenomata of the ovary developed possibly simultaneously or at least independently of one another?

CASE 3. This was previously reported and it was noted at that time as being an apparently isolated adenomyoma of the rectovaginal septum; the pelvic findings in this case were negative, except for the adenomyoma which was palpated rectally. In this instance repeated sections throughout the entire uterus failed to reveal any adenomatous tissue, which should definitely eliminate the uterine mucosa as source of the adenomyoma and further substantiate the conclusions drawn in Case

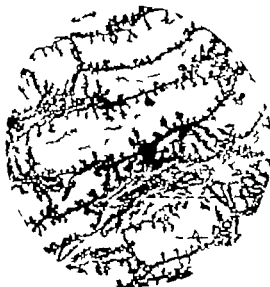


Fig 8 Case 3. Photomicrograph (X65) showing adenomatous glands of rectovaginal septum with glands arranged in somewhat papillary order of Papillary glands stroma with round cell infiltration.

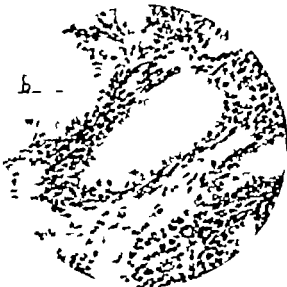


Fig 9 Case 3. Photomicrograph (X5) showing in detail the single layer low columnar cells comprising the glands and the stroma infiltrated with round cells and blood.

Microscopic examination of this section shows a large number of single layer columnar adenomatous structures which are arranged in a papillary and tubular fashion but throughout the growth are orderly and nowhere wildly proliferative. The individual cells of these glands are all about the same size and shape; the cytoplasm and nuclei have similar staining qualities throughout the section; there is a moderate round cell infiltration; the stroma consists of irregular whorls of muscle and connective tissue.

**Diagnosis:** Adenomyoma of the rectovaginal septum.

**Case 4.** Mrs. W., age 35, had been married 10 years, had never been pregnant. Soon after marriage she had had four attacks of severe pelvic pain at short irregular intervals but no recurrence for many years. The menopause took place 1 year ago and there had been no menstruation since.

**Family history:** Father died at 73 of heart trouble; mother died at 49 from cancer; 3 brothers are living and well, one sister died at 38 of cancer.

The present complaints are irregular intermittent recurring attacks of stomach trouble during which the patient vomits two or three times. After the vomiting ceases the attack subsides and the patient is perfectly well. These attacks have recurred for 8 years. At onset they were about 3 years apart but now they recur at intervals of 6 months. There was no history of constipation. The Wassermann, urine, and blood were all negative.

**Physical examination:** There is marked tenderness over the right lower quadrant of the abdomen

with a firm mass palpable in the region of McBurney's point apparently connected with the right adnexa.

Pelvic examination showed a small, normal cervix, uterus three times larger than normal, irregular in outline with a nodule on the right. There was a large mass on the right side involving both tube and ovary. The left tube was enlarged, easily palpated, and tender to slight pressure.

Rectal examination confirmed the vaginal but also demonstrated severe pain on pressure posterior to the cervix.

**Operation:** Abdominal section. Several loops of the small intestine were adherent on the right side to the parietal peritoneum, the tube and ovary to the posterior surface of the broad ligament, the anterior and posterior surface of the uterus, and to other loops of small bowel, so as to form a mass about 8 centimeters in diameter. The appendix was retrocecal and was involved with the cecum in this mass. There were also a small fibroid of the uterus, bilateral large hydrosalpinx, and ovaries of normal size buried in easily torn adhesions. The intestinal adhesions were due to small easily torn extremely vascular friable tissue islets varying in size from 1 to 2 centimeters in diameter.

Microscopic examination of the islets of tissue removed from the small bowel show active inflammation, granulation tissue, and round-cell infiltration. There is also present small glands made of single layer columnar epithelial cells resembling those of the endometrium. There are red blood cells in the gland lumen.



Fig. Case 4. Photomicrograph (X75) showing small gland of single layer columnar epithelial cells buried in inflammatory tissue. *du*, inflammatory stroma; *g*, gland; *v*, granulation tissue blood vessel.



Fig. Case 4. Photomicrograph (X50) showing in detail the gland of single layer columnar cells in stroma of granulation connective tissue and small blood vessel. *g*, Gland; *v*, blood vessel; *s*, stroma.

We feel that this is a type which may be explained by R. Meyer's theory of epithelial heterotopia secondary to inflammatory changes.

#### CONCLUSIONS

1. Hematomata or chocolate cysts of the endometrial type may develop anywhere outside of the uterus provided the normal ovarian function is present to act as a stimulus.

2. In all of these cases there was definite evidence of inflammation varying from the chronic inflammatory process seen in Case 1 to that seen in Case 4 in which newly formed granulation tissue was the predominant characteristic.

3. The growth in Case 1 apparently was not a transplant or outgrowth from the uterus but appeared to be a developmental rest because of its isolation and the ease with which it could be enucleated. Later the presence of plasma and mast cells indicated chronic inflammation.

4. These growths are not only very interesting from an etiological and histological

standpoint but are of marked clinical significance. Their removal has relieved many distressing symptoms.

5. From the study of this group of cases together with others now under observation, we feel that the preponderance of evidence is greatly in favor of R. Meyer's etiological theory that these growths are of inflammatory origin notwithstanding the fact that the presence of tissue in situations where it is not normally found may cause an aseptic inflammatory reaction.

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## GRANULOMA INGUINALE

WITH THE REPORT OF A CASE OBSERVED IN CHICAGO

By S S SCHOCHET M.D. CHICAGO

THE object of this communication is to call the attention of the gynecologist to the not uncommon occurrence of granuloma inguinale in the United States, and to emphasize the necessity of a more careful study of ulcerations of the external female genitalia. Diseases that are regarded as tropical in character have not received sufficient emphasis in our medical teaching with the result that many of these conditions are misoperating under various diagnoses viz. syphilis, tuberculous, etc.

Granuloma inguinale described also as ser-piginous ulceration, groin ulceration granuloma venereum, ulcerating granuloma of the podenda, granuloma ulcereum des organes genitaux, ulcerative vulvitis, and granuloma inguinale tropicum has been endemic in the eastern part of the United States for the past 50 years, and although not designated as such was observed by the late Dr Taylor of New York, and Dr Horwitz of Philadelphia, in the past 25 years (31). Clinically granuloma inguinale was first described in the States by Grindon (15) in St. Louis Missouri, in 1913 but credit is due to Symmers and Frost (42) for the first complete clinical and laboratory study in this country (1920). They actually established the fact that this disease is not peculiar to the tropics.

Granuloma inguinale is necessarily so little known to the medical profession in a temperate climate that it may be of value to include a brief résumé of its history and geographical distribution with a short account of the etiology, pathology, clinical forms, and treatment of this affection.

## DEFINITION

It is usual to begin the description of a disease by defining the morbid condition. In the case of granuloma inguinale however its true etiology has not been definitely established and a discussion of the morbid process

would be of more practical value. The various synonyms thus far given to this condition are misleading.

The term granuloma as first applied in pathology referred to a tumor of granulation tissue or granuloma using the term oma to signify the idea of a tumor formation and since this inflammatory process is caused by an organism, it falls under the group of infective granulomata. The term granuloma inguinale tropicum is a misnomer as the disease is not essentially a tropical one nor are the lesions limited to the inguinal regions like *ulcer granuloma venereum* is misleading as it cannot be classified as a true venereal disease in the sense of gonorrhea, chancroids, etc. Groin ulceration or ulcerative granuloma does not describe the true pathology of this morbid process. The pathological picture is that of a hyperplasia of the epithelial structures and connective-tissue elements with the formation of dense sclerosed bands of connective tissue rather than an ulcerative or degenerative process.

The term chronic infectious granulomata seems to be a better term to employ but until the true etiology is definitely settled there is no logical reason for additional nomenclature of this morbid process.

Granuloma inguinale is a mildly contagious infection of disputed etiology characterized anatomically by a replacement fibrosis with secondary sclerosis and associated ulceration of the overlying tissues, a diffuse perivascular round cell infiltration and the formation of granulomata without caseation or giant cell formation. Clinically the lesions are limited to the genital organs and marked by its chronicity and tendency of recurrence.

## HISTORY AND GEOGRAPHICAL DISTRIBUTION

Serpiginous ulceration or granuloma inguinale was first described by Surgeon Major McLeod (27) in India in 1882. The disease

## SURGERY GYNECOLOGY AND OBSTETRICS

AN ANALYSIS OF CASES OF GRANULOMA INGUINALE REPORTED IN THE  
UNITED STATES[illegible]

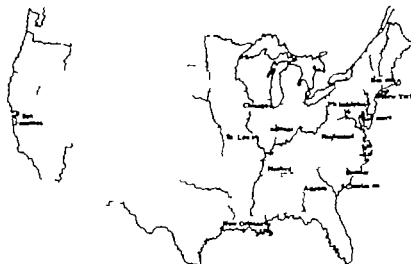


Fig. Distribution of cases reported in the United States

was first designated and defined as a distinct clinical entity in British Guiana in 1896 by Conyers and Daniels (8) among the native negroes but was believed to be a tuberculous groin ulceration. In 1897 Galloway (13) added observations and called the condition ulcerative granuloma of the pudenda. Since that time cases have been reported in Brazil (1) West Indies (14) West Africa (43) South China Australia (41) India (5) New Guinea (30) Central America (36) South Sea Islands, and in many sections of the United States.

While it is more common in the torrid zone yet in certain tropical countries it is not present. In the West Indian Islands (34) it does not occur and is rare in the Malay Peninsula and in Central Africa. It is stated by Poch that it is so prevalent in British New Guinea that special hospitals have been erected for these cases.

In the United States cases have been reported in New York (3, 4, 45) Philadelphia (31) Cincinnati (6) Charleston (22) Sumter (44) Boston (37) New Orleans (12, 33) Atlanta (40) Nashville (28, 30) Richmond (10, 35) San Francisco (43) and in many Southern States. During the past 3 years over 66 cases were reported as shown on the map (Fig. 1).

This is of great significance to our country because once a source of infection has

reached a community numerous cases soon appear especially as there is a predilection for the colored race.

#### ETIOLOGY

Since the disease was first described by Conyers and Daniels (8) in 1896 as a distinct clinical entity many etiological causes have been described. These authors believed it to be a lupoid form of ulceration. Le Dantic (10) considered the process tuberculous and claimed to have produced tuberculosis in animals from granuloma inguinale. In 1904 Donovan (9) described certain inclusions in



Fig. Shows extensive ulceration of labia majora with extension into groin. (Edema of labia majora)





Fig. 3. Section near edge of ulcer showing marked round cell infiltration and sclerosis. Many of the mononuclear cells contain Donovan bodies.

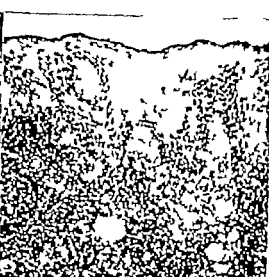


Fig. 4. Section of chronic inflammation. Granulation tissue. Confused with anaplasia because of the disorganized growth of epithelium.

the mononuclear cells found in the lesions. Most observers agree on the constancy with which this microorganism is to be demonstrated in the lesions, and the tendency is to accord it an important rôle in the production of the disease. Donovan believed the germ to be a protozoan. Siebert (38) identified the intracellular organisms as encapsulated diplococci and Martini (36) succeeded in cultivating the organism from the lesions.

Wise (46), Maitland (24), and MacLennan (23) and other observers have found spirochetes of the treponema type, and believe it to be a manifestation of syphilis. Although the spirochetes that may be present in the lesions of certain cases disappear under salvarsan treatment, the ulcerations are not affected by this treatment. This has been confirmed by Cleland and Hukinbotham (7) in cases of granuloma in Australia. Flehn (29) considers the lesion a syphilitic process and sees no reason for separating granuloma inguinale from the phagogenic chancres of extragenital regions.

However, Flu (11) in a very careful study of granuloma venereum thinks that the reaction of the infected cells is suggestive of a chlamydozoa, while Carter (5) in his study of granuloma looked upon these inclusions as granular type of entidias or herpetomonads.

Flu also suggested that this intracellular gram negative organism might belong to the encapsulated bacilli. However in his two series of experiments, the bacilli were not identical, and in consequence of these diverse results Flu states that he considers his cultivation experiments doubtful.

Aragão and Vianna (1) found the intracellular organism constantly present in cases of granuloma inguinale in Brazil and these authors obtained on Sabouraud's media pure cultures of an organism having the same morphological characteristics as those observed in the lesions. These authors consider the organism to be a schizomycete, but to constitute a new germ which they designate as *Kalymmato bacterium* and named the specific organism *Kalymmato granulomatis*. In animal experiments they found this organism to be pathogenic in kittens, guinea pigs, and rats. Walker (43) considers these inclusions as bacilli that belong to the mucosus group. Randall, Small, and Belk (31) also place these inclusions in mucosus group. In a later communication Small and Julianelli (39) in a very careful study on the biological and serological aspect of the bacillus mucosus group, were not able to differentiate these from strains of the mucosus group of the respiratory

tract except that the bacilli of granuloma were more resistant to growth inhibition effect of tartar emetic than the respiratory group.

From these diverse opinions it seems doubtful if the true etiological factor of granuloma has been described. Symmers and Frost state "The evidence that they (inclusion bodies) have a direct causative relationship to granuloma inguinale however appears not to have been definitely established."

**Season.** The disease is not apparently influenced by the season of the year although more cases are observed during the autumn and winter months. This is probably due to economic conditions as dispensary and charitable institutions are more crowded at this period of the year.

**Sex.** While granuloma inguinale may be classified as a venereal disease for example is acquired by sexual connections, it has nothing to do with syphilis or the other usual venereal diseases. Therefore males and females should be equally liable to the affection but Galloway (13) reports a greater number among females in the tropics.

Of the 66 cases reported in this country it was found almost three times more frequently in the male.

	Males	Females
Cases	45	21
Average age	35	26
Duration, average number of years	3 1	3 2

**Age.** Granuloma inguinale has never been observed before puberty. The greatest susceptibility is between the age of 20 and 35. Of the 66 cases recorded there were under 22 years of age 2, between 20 and 30 15, between 30 and 40 13, between 40 and 50 4, above 50 3, age not given 27.

**Race.** Granuloma inguinale has a predilection for the negro race or those of negro descent. Only three or four cases have been recorded in the white race (31, 14, 4).

**Immunity.** There appears to be very little or no immunity toward granuloma except for a slight racial immunity in the white race. One attack does not protect the individual and recurrences are not infrequent. However as we are still in the dark as to the true

etiology of granuloma and sufficient time has not elapsed with the present method of treatment (tartar emetic) no definite conclusions can be made at the present time.

**Incubation.** The periods of incubation have been variously stated as 2 days (Low's 21), 8 days (Maitland 24), 1 month (Hoffman 17) and 3 months after sexual contact (Reed and Wolf 33).

**Distribution in body.** The lesions are more numerous and constant about the genital organs and anus. In the male it appears to be more common at the base of the penis and in the inguinal folds. In the female the labia majora is more frequently attacked and may extend up the vagina but never invades the cervix. Maitland (24) and Beeson (3) report one case with lesions in the buccal cavity and tongue. An associated gangrene of the fallopian tube (22) has been noted in two cases without a reasonable explanation. Whether this is a mere coincidence or a sequelae of the morbid process has not been determined.

**Modes of conveyance.** The lesions appear to follow sexual contact, although auto-inoculation in scarified areas (Walker 43) and in tridermal and subcutaneous auto-injections (Schochet) gave negative results. It does not appear to be highly contagious as it may occur in husband or wife alone.

If the lesions are produced by a protozoan body it is suggested that studies be made with body and pubic lice and other parasites as intermediate hosts. All cases thus reported have been as a result of direct sexual contact.

#### PATHOLOGY

**Gross morbid anatomy.** The changes that occur may be conveniently described in three stages. The typical primary lesion is a papule or small nodule which according to Manson commences in the majority of cases as an insignificant, circumscribed, nodular thickening and elevation of the skin. The affected area is covered with a delicate pinkish epithelium which is easily rubbed off, excoriates readily exposing a surface prone to bleed and break down. Coagulation of the nodules never occurs.

**Secondary stage or ulcerating stage.** The lesions of this stage are vivid in hue and ap-

pear as ulcerated masses of granulation tissue "surrounded by a serpiginous irregular border of nodular somewhat raised, red glazed delicately skinned or pinkish superficially ulcerating or cracked new growth (Manson, 25) The lesion is painless, bleeds easily and at times may be the seat of intense itching.

**Third stage** In this stage the lesions appear very much like other healing ulcers. The edges present a bluish white hue of epithelization. The granulations are irregular but firm. The surface may be covered by a thin, watery secretion. In other areas the healed ossified parts may regress with a breaking down of the thin, shining epithelium and the formation of new granulation tissue. Edema of the parts are not uncommon.

#### HISTOPATHOLOGY

The epithelium is absent over the ulcerated areas. Near the edges the epithelium is thickened and interpapillary processes are much elongated. The various epithelial layers are poorly defined. The regular columnar arrangement of the basal layer of the epithelium is lost while there is either no pigment or irregular deposits in the subcutaneous tissues. Round cells are arranged in masses in the upper layers. Degenerate cells are rare, and there is no evidence of caseation or breaking down of any part of the growth. In some areas, the blood vessels are dilated and congested while in other areas, there are numerous large and small capillaries with angioblastic loops. These are not congested. Gage (12) believes that the dense and diffuse round-cell infiltration in the corium is the most characteristic feature of the lesions. Near the surface of the ulcer polymorphonuclears are numerous and may be found between the epithelial cells. The connective tissue consists of swelling or hydropic degeneration of the white and yellow elastic fibers which is replaced by new connective tissue, which is straighter (fibers) and more compact. This abundant formation of new connective tissue constitutes the essential feature of the cutaneous lesion of granuloma inguinale. "Sclerosing" has been suggested and would be a better term than "ulcerating" as the ulceration

seems to be accidental while the formation of dense fibrous tissue and deep scarring is unvariable.

#### DIAGNOSIS

The diagnosis is made on the finding of the Donovan bodies. The intracellular inclusions are easily demonstrated in the secretions obtained in the deeper parts of the granulation tissue and stained with Wright's stain or Giemsa's method—a modification of Romanowsky's method.

#### CLINICAL FORMS

We may recognize two groups: (a) the ordinary ulcerative lesion with its typical granulation tissue as described under gross morbid process; (b) the spurious elephantiasis with typical areas of granuloma. While the lymphatic glands are not enlarged nor does suppuration take place even with extensive ulcerations, there is, however, obstruction to the lymphatic flow to produce this elephantoid type.

#### SYMPTOMS

The symptoms are purely local. The extensive ulceration with sclerosed granulation tissue is as a rule painless, although intense itching or a burning sensation may be present at times. Except for the sero-aqueous discharge the patient does not seem to be affected by the morbid process. A mild secondary anemia was observed in the author's case. No systemic lesions are present.

#### DIFFERENTIAL DIAGNOSIS

Granuloma inguinale has been confused with tuberculosis, syphilis, epithelioma, and yaws. It can readily be differentiated from epithelioma by the examination of small pieces of excised tissue, from lupus vulgaris it differs inasmuch as it is confined practically to the perianal region, affects mucous as well as cutaneous surfaces, tends to follow in its extension in the linear folds of the skin and is not associated with the tubercle bacilli, giant cells, caseation or other evidences of tuberculous disease from syphilis and yaws by the negative Wassermann, and the absence of glandular involvement and by non-amenability to mercury and iodide of potassium.

# COMPLICATIONS

It should be emphasized that there is no general adenopathy. In spite of the extensive ulcerations that may be present especially in the neglected cases that have extended over a period of years suppurative adenitis seldom occurs. In one case reported by Lynch acute gangrene of the fallopian tube was found the cause of which was not determined. In another case gangrene of the feet was observed. This condition improved rapidly under treatment with tartar emetic. A sufficient number of cases have not been reported to warrant a definite statement in reference to this complication. A mild secondary anemia is not uncommon. Spurious elephantiasis of the vulva, penis or scrotum is common without any evidence of filarial elephantiasis. This was true in Dr. W. E. Persons' patient who had an associated bilateral hernia. The true nature of the lesion was not recognized at the time the writer performed the necropsy. The marked edema and excessive fibrosis was due to blocking of the lymphatic stream in some way not solved at present.

# PROGNOSIS

With the intravenous use of antimony the local lesions rapidly disappear but there is a tendency for recurrence or the development of new lesions in the scar unless treatment is continued for some time with one of the antimony compounds. It must be borne in mind however that too prolonged use of antimony produces fatty degeneration of the liver, kidney, heart and muscular tissue of the diaphragm (Prestley). It does not appear to affect the general health of the patient, although the lesions may exist for years. Antisyphilitic treatment is useless.

# PROPHYLAXIS

The disease should be placed on the list of reportable infections and patients should be placed in hospital quarantine. Segregation should be compulsory as most of the unfortunate individuals belong to the lower strata of society and even with extensive lesions sexual relations are indulged in. As these cases are rebellious to treatment and painful it is not uncommon that many of these patients desert

The health department of the city of Chicago does not require that this disease be reported (16).

# TREATMENT

This disease is very intractable to treatment. X-ray caustics and the use of the actual cautery have been employed with partial success. Complete excision has been advocated in the past as the best means for permanent cure.

The use of antimony was first suggested by Mesnil and Nicolle (21) in the treatment of trypanosomiasis but the credit is due to Arapio and Vianna for popularizing this method of treatment. However it must be remembered that antimony compounds should not be used too freely. Deaths have been reported from the use of antimony and the author has seen one death following the intravenous administration of this drug. Crevin (6) in 1908 wrote that there is no drug with which one might more secretly poison a man, and the students of Hekelberg were required at one time to take oath never to use it. According to Salkowski and Prestley the prolonged use produces fatty degeneration of the liver, kidney, heart, and muscular tissue of the diaphragm.

Lasbrey and Coleman (18) report ten deaths that could be attributed to antimony tartrate in a series of one thousand cases of bilharziasis treated with this drug.

Randall reports renal irritation following the administration of tartar emetic in two cases of his series. Pains in the long bones and shoulder girdle, rheumatoid in character, is considered physiological following the administration of 0.1 gram on alternate days. Yet antimony or one of its salts is the best drug at our command in the treatment of granuloma inguinale.

The tartrate of antimony is best given intravenously on alternating days with an initial dose of 0.5 or 0.1 gram with increasing doses to 0.9 gram. Shortly after the intravenous administration the patient may complain of severe pains in the arm especially if administered too rapidly. In other cases severe pressure pains in the chest may be encountered.

In a recent paper Randall (32) reports brilliant results with the intravenous injection of

sodium antimony thioglycolate and triamkle of antimony thioglycolate prepared by Prof John Abel of Johns Hopkins University. No toxic effects and complete absence of symptoms were noted in these cases.

## SUMMARY

1 Granuloma inguinale is becoming more common in the United States, and is no doubt masquerading under various diagnoses.

2 A careful study of all ulcerations about the genitals should be made for Donovan bodies especially in those cases in which syphilis and tuberculous have been eliminated.

3 Granuloma inguinale is never associated *per se* with general adenopathy.

4 Granuloma inguinale should be placed on the list of reportable diseases.

5 Antimony compounds are specific for granuloma inguinale.

## CASE REPORT

*History.* The case here recorded occurred in a female patient, age 36 married, para II. There is nothing in her heredity of any importance as related to the present condition. Five years ago small papule appeared on the labia majora which soon broke down to extensive ulceration. She received antiseptic treatment for period of years with negative results. Two years ago she was treated with intravenous injections of salvarsan for period of 3 months without any effect on the lesion.

The case as first seen by the author in the Dispensary Service of Post Graduate Hospital on the service of D. Scott. No diagnosis was made except Wassermann test was requested which was negative.

*Examination.* The patient was well developed and nourished black female, height, 5 feet 6 inches, weight 135 pounds. Eyes ears and nose were negative. Marked pyorrhea with several decayed teeth. Heart chest and abdomen were negative. Vulva showed an extensive ulceration involving the whole of the right labia majora and extending up the thigh. The ulcerations were somewhat nodular firm and composed of dark purplish red granulation tissue. There was no general adenopathy.

Wassermann negative with cholesterrum and cetone insoluble antigen. Stained smears from the deeper portions of the granulation tissue shows many mononuclear cells containing Donovan or granuloma bodies.

*Treatment.* Injections of timon showed rapid improvement. After three weeks treatment with antimony the lesions that measured 6 by 6 centimeters were healed and covered with epithelium.

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## CONGENITAL CYSTIC KIDNEY IN THE NEWBORN

By HARRY A. SAGER, M.D. AND JULIUS BRAMS, M.D. CHICAGO

From the Department of Rectrology and Pathology, University of Illinois College of Medicine, and the Pathological Laboratory of the Cook County Hospital

A REVIEW of the literature fails to reveal any satisfactory statistics regarding the incidence of congenital cystic kidney but the opinion prevails that the disease is rare. There is certainly a large number of cases which are never reported. This fact along with the difficulties encountered in diagnosing this condition and the impossibility of performing routine autopsies probably accounts for the small number of cases recorded. When available statistics are collected we find that in 1914 Barnett (1) collected 251 authentic cases and that since then about 100 cases have been reported. It is obvious that, contrary to the usual idea, congenital cystic kidney is quite common. It is only because of the unusual features of our case that we are reporting it.

Baby M. C. born 5:1 p.m. died 6:40 p.m. The mother of this infant entered the obstetrical ward of the Cook County Hospital in labor which began about 6 hours before admission, and was delivered twice. She was 3 years old, colored and gave a history of bearing a child 3½ years old, living and well, and of a spontaneous abortion at 3 months about 2 years ago. She further states that the present pregnancy has been normal and that there was no escape of water previous to admission. On examination diagnosis of dry labor cephalic presentation in the occipital-anterior position was made. During the delivery large pieces of vernix caseosa were expelled. The child, as normal except that the abdomen was distended and contained palpable mass on the right side. The Wassermann reaction on the placental blood was negative. The respirations of the infant at birth were labored and all measures for stimulation failed to bring about any change in the poor condition of the infant and it died shortly after birth.

The postmortem diagnosis was as follows: congenital polycystic kidneys, partial congenital atelectasis of the lungs and subpleural emphysema. There were no cysts in any of the other organs and no other congenital defects. For the sake of brevity we will describe only the kidney.

Grossly the left kidney measured 8 centimeters in length, 4 centimeters in width and 4.5 centimeters in thickness. There was no distinct pelvis visible and the ureter seemed to take origin between a mass of cysts and measured 3 millimeters across. The

entire surface of the kidney was studded with cysts which varied in size from millimeters to 4 centimeters in diameter. The cyst walls were tense, somewhat translucent and contained a straw-colored fluid within them. On the surface of the cysts many fine blood vessels were seen distributed irregularly. From one to eight daughter cysts were present on the surface of many larger cysts. The fluid from the cysts as straw-colored and the amount contained in each cyst varied from drop to cubic centimeters. Upon removal of the fluid the cyst walls collapsed. The capsule of the kidney was somewhat thickened and stripped with difficulty. In many places, but especially to the areas of fibrous tissue between the cysts the capsule was firmly adherent. There was very little perirenal fat present. The weight of the kidney was 70 grams. On cut section the entire substance of the kidney was seen to be replaced by cysts. Between the cysts there was large amount of immature connective tissue which was very vascular. The inside of the cysts opened into each other. The cyst wall measured about 3½ millimeter in thickness. The pelvis could not be found, but the ureter opened into cyst at the site of the pelvis. The right kidney was essentially the same as the left (Fig. 1).

Microscopical examination of sections from various portions of each kidney were made. The cyst walls were seen to be formed by immature connective tissue and were lined with a single layer of cuboidal epithelium. There was large amount of embryonic connective tissue interspersed between the cysts, the cells of which were numerous and contained many nuclei. This connective tissue

as very vascular and the many vessels were dilated and engorged with red corpuscles. In several places small islets of embryonic kidney tissue in the form of underdeveloped glomeruli and tubules presented themselves. The glomeruli were made up of from 1 to four tufts. The cells in the tufts were increased in number and contained many nuclei. The Bowman capsules were somewhat dilated and here also the cells contained several nuclei. The tubules were irregularly distributed, seemed somewhat dilated and the cells contained many nuclei. There was no systematic arrangement of tubules and glomeruli and between the islets of kidney tissue was large amount of embryonic connective tissue. The kidney had reached a state of development seen in a 6 months fetus.

Chemical examination of the fluid in the cysts showed 45.96 milligram of urea, 66 milligrams of urea acid, 35 milligrams of creatinine and 740 milligrams of chlorides per 100 cubic centimeters of fluid. The physical properties resembled those of

b. c. The fluid was somewhat turbid. It  
 red contained 1.5 mm. and macroscopic ill  
 seen it contain red blood cells and epithelial  
 cells.

Most of the interest in this disease center  
 about its etiology. In analyzing the reported  
 cases arguments in favor of all the accepted  
 theories can be found. There also appear two  
 facts which seem to be important factors in  
 deciding which is the most logical theory.  
 These are the influence of heredity and the  
 presence of other fetal anomalies. A number  
 of cases appear in the literature in which





In infancy The cases reported by Wobus (2) Green (8) Smith (9) Jepson (10) Bunting (3) Graves (11) Leopold (12) Royster (13) Greene (14) Fullerton (15) and Glasser (16) represent practically all the reported cases in infants. In this series the ages range from 11 days to 5 years and the average age is 16 months. Glasser in a thorough review of the literature up to the time of his report finds only twelve cases reported during the first year of life. We have been unable to find any record of a case occurring in a newborn infant which lived just hours and believe our case is unusual in this respect.

It is not the purpose of this paper to enter into a discussion of the symptoms, diagnosis, and treatment of this disease. The rôle of congenital cystic kidney in the production of dystocia is common knowledge. Williams (17) De Lee (18) and the authors of most text books in obstetrics mention the occasional occurrence of congenital defects in the fetus as a cause of dystocia. It is interesting here to note that in our case there was no dystocia at all and no evidence of pathology except for the dry labor. In personal communication with several obstetricians we have been told that a dry labor should always lead one to suspect an anomaly of the urinary tract in the fetus.

## SUMMARY

A dry labor was followed by the birth of a fetus which was normal except for the presence of congenital cystic kidneys.

The microscopical examination of the kidney tissue and the chemical examination of the cyst contents tend to corroborate the theory of defective development *in utero* as the cause of this disease.

The age of the infant, the absence of other anomalies, the fact that there was no dystocia and the presence of urea, uric acid, creatinine and chlorides in the cyst contents are added points of interest.

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## A STUDY OF THE PRESSURE HOUR-GLASS OR CASCADE STOMACH

ITS NATURAL AND EXPERIMENTAL PRODUCTION WITH CASE REPORTS<sup>1</sup>

By RICHARD A. RENDICH, M.D. BROOKLYN, NEW YORK

Roentgenologist, Bellevue Hospital, New York

AND

JOHN F. CONNORS, M.D. NEW YORK

Director, Surgical Division, Harlem Hospital

THE so-called pressure hour glass "cascade" or cup and spill form of stomach has received but a small share of the consideration which is due to so important a condition. The general lack of a clear clinical and roentgenological conception of this affection frequently leads to erroneous interpretation and to needless surgery.

The name cascade by which it is better known has been applied to that gastric deformity in which the posterior wall of the pars cardiaca forms a definite pouch and becomes distended with mixture before any descends to the lower pole. The remainder of the stomach fills from the overflow of this pouch in waterfall fashion. It is from this manner of filling rather than from the deformity or its causative factors that it has been so styled.

In Webster's (1) recent review of the literature pertaining to this subject he offers the opinions of Stierlin, Asmann, Schlesinger, Carman, Barclay and others, concerning the underlying cause of the cascade stomach, spasm with and without intrinsic lesion adhesions, and pressure from various sources are suggested. One is impressed by the lack of unanimity as to the factors necessary for the production of this condition. The situation is well described in Webster's conclusion. It is evident from this summary of cases up to the present that the whole subject of cascade or cup and spill stomach requires further observations before organic or spasmodic types can be clearly differentiated.

Normally the entire posterior wall of the stomach lies in an oblique plane the cardiac

portion being situated posteriorly while the lower pole more closely approximates the anterior abdominal wall. The inclination of this plane varies as does the habitus of the individual the obliquity tending more to the horizontal in the hypersthenic type. In the cascade stomach the posterior walls of the pars cardiaca and of the pars media are in different planes that of the latter being anterior. In other words the major part of the vertical arm is displaced forward thereby producing an incomplete division of the pars media from the fundus.

It can be readily seen then that the condition thus produced may vary from a simple shelving of the posterior wall pars cardiaca to definite locule formation. Realizing this variation we have endeavored to classify such cases according to degree viz. first degree, simple cardiac shelving in which the fundus fills first but practically none of the mixture is retained in this region for any appreciable time second degree 1 to 4 ounces (approximately) is retained in the upper portion before overflow occurs third degree the capacity of the upper locule is more than 4 ounces. It is in the last class that residue at the 6 hour period is noted in the cardiac locule while none remains elsewhere in the stomach. Because of the pressure about the lower sac evacuation of its contents is usually rapid.

The deformity of the cascade or pressure hour glass stomach results from forward displacement of the more mobile portion of the vertical arm by pressure exerted along the posterior wall. This pressure is more commonly caused by a distended splenic flexure less often by new-growth particularly of

<sup>1</sup>From the Department of Roentgenology, Bellevue Hospital.



Fig. 1. Case. Pressure hour glass stomach, third degree in patient with extensive carcinoma of esophagus. Position right anterior oblique vertical after administration of sediment mixture. Note large lobe of pars cardica with its flood level and second lobe of pars media and pylorus also presenting definite flood level.



Fig. 2. Case. Same condition as Figure 1 demonstrating the appearance of each deformity in the postero anterior critical posture and the relation of lobes, the lower being more medially placed.



Fig. 3. Case. Same position as Figure 1. Stomach now all filled—condition not as striking. Lower border of upper lobe (accentuated by dotted line) superimposes the pars media.

retroperitoneal origin. Anatomists mention the relationship of the splenic flexure to the posterior wall of the stomach; this is corroborated roentgenologically in individuals of the asthenic and hyperasthenic types, but in the hyposthenic and asthenic patients the splenic flexure is usually found to the outer side of the greater curvature. Consequently distention of the splenic flexure of those of broad habitus may give rise to the deformity of the stomach as described.

The cascade form of stomach has been observed in our work, only in association with a distended splenic flexure or a retrogastric mass. Spasm and adhesions have been offered as causes of the cascade stomach but on analysis of the deformity it becomes difficult to support this contention. A simple incisura (of intrinsic or extrinsic origin) at the junction of the partes cardica and media should cause no greater deformity than a spastic indrawing elsewhere in the stomach. The latter serves only to produce a bilocular



Fig 4 Case. Conditions as in Figure 3. Position, left anterior oblique, critical-bilocular appearance still present but not as marked as before filling the stomach.

stomach without disturbance of the antero-posterior relation of these locules while in the pressure hour glass stomach the pars media comprising the major part of the lower locule is displaced forward. Furthermore anti-spasmodics have been administered without altering the condition.

Adhesions of the greater or lesser curvatures tend to displace the stomach to one or the other side while those confined to the anterior surface draw that segment forward but do not disturb the plane of the posterior wall. Fixation of the posterior surface would tend to retract this wall backward but the reverse of this is true for the cascade type. The only adhesion capable of producing a deformity similar to that of the cascade stomach would be one of the posterior wall encircling the stomach and being fixed anteriorly but with this there might be expected a constriction of the lesser and greater curvatures which is not found in the type under discussion. Adhesions of the posterior wall, however, may be present with this condition, very likely the result of continued



Fig 5 Case. Pressure hour glass stomach, third degree—caused by large retroperitoneal sarcoma (autopsy). Position, right anterior oblique vertical. After administration of large quantity of mixture. Note the extremely large upper locule of the pars cardia and the relatively small size of the partes media and pylorica and the forward displacement of the latter.



Fig 6 Same patient as in Figure 5. Position, postero-anterior, critical. Note relative size of upper and lower locules of pars cardia, lower border of upper locule which lies behind the pars media is accentuated by dotted line.

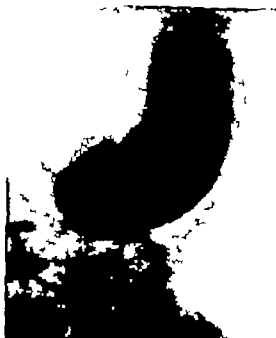


Fig. 7. Case 3. Normal stomach in postero-anterior vertical position.



Fig. 8. Case 3. Normal stomach in right anterior oblique horizontal posture.

irritation of the splenic flexure against this surface of the stomach.

An organic lesion of the alimentary tract is occasionally discovered concomitant with a cascade stomach and some consider that a definite relationship exists between the conditions. Such findings, however, are exceptional and offer no proof that the cascade deformity was the result of the accompanying lesion.

Figures 1 to 4 demonstrate the pressure hour glass stomach of an elderly man suffering from carcinoma of the esophagus, but no relation between these conditions can be suggested. It is assumed that this case is representative of the group in which the gastric deformity is coincidental and has no direct association with the existing organic lesion. Gastrotomy was later performed on this patient at another institution and the surgeon's notes record no abnormality of the stomach.

The deformity as described is more striking when only a small amount of the mixture is administered (Figs. 1 and 2) and is best

visualized fluoroscopically during ingestion in the vertical anterior oblique postures. The deformity of the third degree case is often so marked that it may be misinterpreted as a true hour-glass stomach consequent to an organic lesion, as gastric ulcer when the cardiac sacculi is deep. It is sometimes mistaken for a diverticulum. If a correct diagnosis has not been reached by complete study the somewhat perplexing radiographic findings in conjunction with the persistence of symptoms leads the patient to unnecessary operation.

Filling the stomach to capacity tends to overcome the pressure exerted by the distended splenic flexure and consequently toward obliteration of the deformity (compare Figs. 1 and 4). This, however, does not hold true for the cascade type produced by new-growth since such retrogastric pressure cannot be overcome in this manner (Figs. 5 and 6).

As an aid toward differentiation of organic from pressure hour-glass stomach, the following features are important.



Fig 9 Case 3 Pressure hour-glass stomach experimentally produced by colon inflation. Left anterior oblique posture. Note similarity of Figure 4 which represents natural pressure hour-glass in the same position note the definite locule formation which, however, is not as marked as before filling of the stomach.

#### Organic Hour-Glass Stomach

Constriction of one or more borders, if but one, it consists of an indrawing of the greater curvature.

Constriction usually present in pars media.

No disturbance of the anteroposterior relation of locules.

No disturbance of the lateral relation of locules, except occasionally by adhesions.

Irregularity of gastric contour.

Organic lesion present.

Appearance more pronounced on administration of large quantities of contrast.

Condition persists.

#### Pressure Hour-Glass Stomach

Constriction of posterior all only.

Constriction present only near junction of the pylorus, cardia and media.

Lower locule displaced forward.

Lower locule usually displaced medially.

Gastric contour regular.

Organic lesion rarely present.

Appearance much less marked on distention of stomach.

Condition non-persistent. Minor degree of deformity may be absent on re-examination.



Fig 10 Case 3 Same condition as in Figure 9—in right anterior oblique vertical position. The lower border of the upper locule is below the level of the lesser curvature pars pylorica.

than those of any other abnormality of the gastro-intestinal tract. A sense of distress referred to by some as pressure, by others as distention is complained of in the left hypochondrium, laterally and posteriorly the sensation is continuous for periods, aggravated by constipation and relieved by expulsion of flatus or evacuation of the colonic contents. This symptom results from the distention of the splenic flexure. After meals eructations and regurgitation of food are common. Cardiac palpitation sometimes occurs. The post-cibum distress may be less after a large rather than a small meal. This discomfort is due to the distention of the cardiac locule by food retention and gas accumulation. It might be obviated by the ingestion of large quantities at a time since the sacculiformity is reduced by increasing the gastric content. Relief from the disturbances experienced after eating is obtained by means of various original methods viz., massage of abdomen moving about during meal partaking of food while standing and by assuming a prone position.

Associated with the pressure hour-glass stomach there occurs a pathognomonic group of symptoms, perhaps more characteristic



Fig. Case 4. Gastro-intestinal tract of the writer after inflation of the colon with air—note the relation of the splenic flexure to the outer side of the stomach in one of hyposthenic tendency.



Fig. Case 4. Same conditions as in Figure 4. Right anterior oblique position. Demonstrating that no deformity of the stomach is produced on account of splenic flexure relation to the outer side of stomach rather than behind same.

tion. From a radiographic viewpoint the last should serve most efficiently since it permits the cardiac locale to empty readily.

The following case histories typify those obtained from patients suffering from a distended splenic flexure with resultant pressure hour glass stomach. The description of the complaint is frequently so characteristic that the diagnosis can be offered before radiographic examination is made.

**CASE.** Male, age 47, occupation, silversmith. Duration of symptoms, 6 months. Chief complaint continuous sense of distention referred to back and lateral aspects of left hypochondrium. Eructations and regurgitation of food after meals, no vomiting, relieved by prone position. Palpitation, bowels move each day, no blood, no jaundice.

**CASE.** Male, age 33, occupation, fireman. Referred with clinical diagnosis of gastritis. Duration of symptoms, 6 years. Chief complaint distress in left upper quadrant referred to side and back of this region, distress is constant, aggravated by constipation. Feels bloated after meals. Eructations and regurgitation of food after eating, no vomiting, no jaundice, bowels constipated, move each day with medication.

On fluoroscopic examination both of these patients presented the typical cascade stomach caused by pressure from the gas distended splenic flexure. No other abnormality of the gastro-intestinal tract was discovered in either case. The deformity was much less marked on filling the stomach to capacity, thereby again demonstrating the necessity of examination with a relatively small amount of liquid, preferably a sediment mixture.

The deformity is not always persistent, as patients presenting this picture may have a stomach normal in every respect on re-examination at a later date if during the interim the distention of the splenic flexure has been relieved.

*Experimental production of pressure hour glass stomach in hypersthenic individual.* In an endeavor to corroborate the view that a cascade stomach is the result of pressure, the alimentary tract of a patient of hypersthenic habitus was examined completely by routine



Fig. 3. Case 4. Same conditions as Figure 1. Left anterior oblique position: slight indentation only of greater curvature aspect of pars media by the distended ascending arm of the splenic flexure.

fluoroscopic and radiographic methods and no evidence of any abnormality was noted. The stomach was of normal size, shape, position, and contour (Fig. 7) in the oblique views; the posterior wall was found to be of definitely regular outline and lying in a plane of moderate obliquity (Fig. 8).

Proof that a given factor is a cause of a known condition is to produce the condition by it; consequently it was decided to distend the splenic flexure of this patient who had been found to possess a stomach radiographically normal in all respects. After complete evacuation of the first meal a rectal tube was inserted and the colon inflated with air until the splenic flexure was well distended. The patient was then placed in the right anterior oblique vertical position and fluoroscopic observations made during the ingestion of the opaque liquid. On reaching the cardia the mixture did not immediately descend to the lower pole as in the routine examination, but collected in a sac-like formation of the posterior wall pars cardiae, until



Fig. 4. Case 5. Before operation—naturally produced pressure hour glass stomach, third degree. Left anterior oblique vertical demonstrating definite locule formation of the pars cardiae in which portion, only retention of 16 hour period was present. Note relation of locules and also gaseous distention of splenic flexure.

this locule filled, then overflow occurred into the lower pole in true cascade fashion. When the pars media had been filled it could be noted that this portion had been displaced forward and upward by the inflated splenic flexure (Figs. 9 and 10) thus producing experimentally a typical pressure hour glass stomach in a patient found previously to possess a normal gastro-intestinal tract.

*Experiment with hyposthenic type.* In an attempt to demonstrate the stomach colon relation in the individual of hyposthenic tendencies and further to experience symptoms thus produced the writer's (R. A. R.) colon was inflated with air and an opaque meal ingested. Fluoroscopic examination was made during the administration of the mixture and no abnormality of position of the stomach or unusual relation of its divisions was noted. It was, therefore, demonstrated by this procedure that a cascade type was not produced





Fig. 5. Case 5. Before operation—same position as Figure 4. After filling stomach, fecule formation much less marked. Note angle of anterior wall at junction of pars cardia and media due to distention and no doubt corresponding to the site of herniation.



Fig. 6. Case 5. After operation. Postero-anterior vertical. No deformity of the stomach noted in this or either oblique view.

because of the position of the splenic flexure to the left of the stomach rather than behind it as in the hypersthenic patient and further the entire left half of transverse colon was found to be in relation to the greater curvature of the stomach (Figs. 11 to 13). The symptoms witnessed consisted of a general abdominal distention, with slight nausea and a desire to eructate; the gastric symptoms no doubt would have been more marked had the pressure of the splenic flexure been directed against the stomach as in the cascade type.

A most interesting and instructive case in conjunction with the discussion of pressure hour glass stomach is that which occurred in the service of Dr. John F. Connors (3) at Harlem Hospital, to whom I am indeed much indebted for the opportunity accorded me to examine this patient after her operation. Appreciation is also expressed to Dr. William Robinson, roentgenologist to Harlem Hospital for his co-operation.

Patient (service of Dr. Connors) adult, female, admitted to Harlem Hospital, August 6, 1932, with diagnosis of appendicitis. Chief complaint distress after meals. Family history negative. Previous history indigestion for past 5 years, otherwise irrelevant.

Present history. Day before admission, patient began to feel sick complaining of headaches, nausea, and cramplike pains through abdomen. Upon questioning, the full history is elicited. Immediately after a few mouthfuls of food there is fullness in the left upper quadrant of abdomen. Patient says that she is able to relieve this by massage and moving about. Lately she has been taking her meals standing. With this distress there are frequent gaseous eructations and sour tastes, but there is no vomiting. This distress is always in the same area, that is in the left upper quadrant, in which constant tenderness is present. She has no hunger pain. Of late she has discontinued using sour liquids and starchy foods because of the great distress which follow.

Gastro-intestinal roentgen examination ordered and revealed. Six hour examination shows retention in pouch like formation of the lesser curvature, pars cardia, just opposite the epicald portion of the esophagus; no other gastric retention. As more tablespoonful of barium mixture are given, this does not fill the pars pylorica as usual but fills



Fig. 7 Case 5 After operation. Incomplete artificial distention of the splenic flexure. Left anterior oblique vertical. Note the tendency to locule formation of the pars cardia and the forward displacement of the pars media.

the pouch first as more of the opaque mixture is given the last overflows the pouch and passes into the pars pylorica (Figs 24 and 25). The pouch formation which appears like a diverticulum is persistent on three different examinations the last examination having been made after the administration of tincture of belladonna (as antispasmodic) for 5 days, 5 drops three times a day.

D. Connors reports that at operation an incomplete herniation of the anterior wall of the stomach through the gastrosplenic omentum was found judging from the roentgenograph (Fig. 5) such condition was undoubtedly the result of the prolonged distention of the cardiac locule. Further the operative report states: "There were no adhesions, induration, or other evidence of inflammation. The stomach walls were quite normal save for apparent slightly thinner wall in the region of the herniated portion as from repeated stretching."

After operation and while the patient was still in the hospital, second radiographic examination was made which disclosed normal gastric motility, there being no retention in any part of the stomach at the 6 hour interval and further this organ now assumed normal position, characteristic of her type (Fig. 6). The patient at this time was symptom free.



Fig. 8 Case 5 After operation. Examination following second and more complete artificial distention of the colon. Right anterior oblique vertical. Not definite locule formation. The opaque level in each. Also not relation of hepatic flexure to greater curvature, pars pylorica. Note similarity to Figure 17 which represents naturally produced deformity in the same posture.

*Experiment No. 3 Reproduction of cascade stomach.* Feeling assured that the ante-operative condition could be reproduced we asked to be allowed to study the patient after air injection of the colon as described in previous cases. Unfortunately sufficient air could not be injected at this time because of defective apparatus enough however was injected to demonstrate definitely the condition before operation but to a less marked degree (Fig. 17).

At a later date the procedure was repeated the colon was well distended with air and the usual opaque mixture given by mouth. The result was a definite loculation of the pars cardia in which a large quantity of the ingesta collected before spilling over into the lower pole occurred (Fig. 18). The pars media was displaced forward (Figs. 19 and 20) thus was produced the exact condition as prior to operation. Further on be



Fig. 10. Case 5. Condition as in Figure 8, after filling stomach, postero-anterior vertical posture. opaque level in each locale demonstrated by lines. Note stomach colon relation.

ing questioned the patient at this time, stated that during the procedure she experienced the same discomfort as prior to operation.

CONCLUSIONS

1. The result of these experiments and the investigation of the not uncommon naturally produced cases prove that the deformity referred to as cascade stomach is the result of retrogastric pressure which causes forward displacement of the mobile portion of the vertical arm of the stomach from the firmly fixed cardia. The most common source of such pressure is the distended splenic flexure. This condition occurs independently of any organic lesion of the alimentary tract.

2. Since the radiographic appearance of the gastric deformity simulates the true hour-glass stomach and since the cause of this



Fig. 11. Case 5. Condition as in Figure 9, left as tense oblique posture. Demonstrating definite bilobular appearance.

condition is pressure it is suggested that the term pressure hour-glass stomach is more descriptive to those unacquainted with the fluoroscopic cascade effect.

3. With the uncomplicated case of pressure hour-glass stomach there occurs a definite group of symptoms characteristic of the condition.

4. The condition as described (excluding those cases which are the result of neoplasms) represents a definite clinical entity and the treatment should be directed to the underlying cause that is, the colon rather than the stomach.

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## GUMMA OF THE THYROID

By CARRINGTON WILLIAMS, M.D. RICHMOND, VIRGINIA

Associate in Surgery, Medical College of Virginia

AND

BERNHARD STEINBERG, M.D. RICHMOND, VIRGINIA

From the Surgical Service, Hospital Department, Medical College of Virginia

GUMMA of the thyroid gland is among the rare manifestations of syphilis. Several recent monographs on goiter scarcely mention it, and textbooks on pathology pass it by with the statement that it is rarely seen.

Davis (1) in 1910 collected 19 cases from the literature and reported one case. Three of these cases as noted by Seneviratne (2) did not have gummatous syphilis but rather were manifestations of the secondary stage of the disease. Seneviratne (1918) then recorded 6 cases reported after 1910 and added one of his own.

Schneider (3) in 1918 reported a woman of 48 who had a goiter thought to be malignant but an exploratory operation and the pathological report proved it to be gumma. This mass disappeared under antileptic treatment.

It is interesting to note that goiter not infrequently is observed in the earlier stages of syphilis. Textbooks on syphilis refer to a moderate enlargement of the thyroid as being frequently seen in the secondary stage of the disease.

Davis (1) calls attention to the possibility of this enlargement being due to administration of iodide. He says: "Swelling of the thyroid occurs frequently in early secondary syphilis. The question as to whether or not this swelling is due to the syphilis or the treatment, or whether there may be two distinct types of thyroid enlargement in secondary syphilis, the one due to the syphilis, the other to the use of potassium iodide is still open."

Storck (4) in 1917 and Simonton (5) in 1918 reported cases of goiter and syphilis in which the goiter disappeared under treatment. These however were apparently nontumorous.

Clark (6) in 1914 reported a case of exophthalmic goiter with the typical exophthalmos and pulse of 100 and a strongly positive Wassermann, relieved with mercury and

salvarsan. The condition recurred in a year and again responded to treatment.

It is also interesting to observe that Cones (7) in 1922 reported a case of gummatous cervical adenitis and referred to four other cases previously reported by him.

The case of gumma of the thyroid reported by Gombault (8) in 1884, quoted by Davis, showed gummatous adenitis as well. One of our cases had this same combination.

These two cases were admitted to the hospitals of the Medical College of Virginia.

**CASE.** Mrs. R. B. White, female, widow, age 60, was admitted to the Memorial Hospital on October 7, 1923. The chief complaint was constant cough, and the family history was unimportant.

**Past history.** She had pneumonia at age 55, was operated on 20 years ago for ovarian trouble, and has not menstruated since. Shortly after this she was operated on for hemorrhoids. One year ago she had asthma.

She has three children, living and well, and has had no miscarriages. The past history is otherwise unimportant.

**Present illness.** Five months ago she noticed difficulty in breathing and severe cough. During the last 3 months the cough and dyspnea have grown very much worse. Soon after the onset of the cough she noticed a hard mass in the right side of the neck, which has grown slowly to its present size. About 6 months ago a smaller mass was observed behind this larger one. She now has great difficulty in breathing and frequently has long paroxysms of hard coughing. She has not noticed any loss in weight.

**Physical examination.** The patient is an obese elderly woman. Her complexion is low pitched and dusky, and at frequent intervals she has severe paroxysms of coughing. In the lower part of the right anterior triangle of the neck there is a very hard nodular tumor about the size of an egg which rises and falls with the trachea on swallowing. This mass is not attached to the skin but is not freely movable. It seems to be located in the right lobe of the thyroid. Behind this mass and about 1 inch from the sternomastoid muscle is a small soft mass adherent to the skin, apparently an enlarged lymph node. The heart and lungs are negative. Physical examination is otherwise unimportant.

Fluoroscopic and X ray plates of the chest fail to show intrathoracic goiter or any other pathology. The Wassermann reaction is four plus positive.

The small node was removed under local anesthetic and was reported by the pathologist to be gumma.

She was given neosalvarsan, mercury and large doses of iodine, and was discharged months after dismissal. On discharge there was no cough nor dyspnea and both tumors had entirely disappeared. She was seen 8 months later. At this time there was no evidence of the tumor and no cough but she was still somewhat hoarse.

**CASE E C** colored female, married, age 44, was admitted to the St. Philip Hospital on June 22.

The chief complaint is tumor in neck and difficult breathing.

The family history is unimportant.

**Past history**—She has been married 9 years and has one child—years of age in good health. Three children died in infancy. She has had no miscarriages. The past history is otherwise unimportant.

**Present illness**—Nine months ago she noticed small lump in the lower neck just to the left of the midline. It has grown steadily to its present size. The tumor has always been very hard. There has been no pain. Seven months ago she began to have some difficulty with breathing, and a month later dyspnea was quite marked. There has been no difficulty in swallowing. A few months ago she noticed that lifting her left arm above her head cut off breathing. She feels weak and has lost 5 pounds in weight. Now she has great distress in breathing, and has frequent hoarse cough.

**Physical examination**—Patient is a well developed fairly well nourished negro woman suffering with greatly embarrassed breathing.

The neck presents a large goiter involving principally the left side of the neck. The tumor is the size of an orange, is nodular very hard, and firmly fixed in position. The skin is not adherent to the mass. The largest circumference of the neck is 5 inches.

The heart and lungs are negative.

The general physical examination was otherwise unimportant.

Laryngeal examination showed a normal larynx pushed over to right of the midline.

**Blood count**—Hemoglobin, 80 per cent; leucocytes, 7000; polymorphous neutrophils 68 per cent; small lymphocytes, 30 per cent; large lymphocytes, 2 per cent.

The urinalysis was negative.

The Wassermann reaction on the blood was four plus positive.

No evidence of substernal goiter or mediastinal growth was found on X ray.

The basal metabolic rate is minus 25.

The tumor was explored through the usual transverse incision, and found densely adherent to the trachea and surrounding muscles. A small piece

was removed for histological examination. The tumor was reported gumma.

The patient was given mercury salvarsan, and large doses of iodine and when last seen 2 months after leaving the hospital, she was much improved. The tumor was considerably smaller and softer and the embarrassment of respiration was entirely relieved. The neck no longer measured 4 inches in its greatest circumference.

These two cases had symptoms and signs which appear to be typical of the disease, yet the resemblance to carcinoma was so marked that we did not feel justified in making the diagnosis of gumma without the histological examination. The tumor may be large or small. It is usually nodular and always very hard. The skin may or may not be adherent, but the growth is usually adherent to surrounding structures and therefore firmly fixed in position. The surrounding tissues as the gumma grows are destroyed, and the tumor then, as would be expected soon gives severe symptoms of tracheal and laryngeal pressure, and a number of cases are reported to have died of suffocation even after tracheotomy. Both of our cases had the harsh, hoarse cough and hoarse croaking voice without demonstrable vocal cord lesion. This adherence of the tumor to the surrounding structures accounts for the serious interference to breathing on raising the arm on the affected side above the head noted in both of our patients. Both of them complained that they could not fix their hair. This sign would probably be present in any large hard, adherent goiter. Other lesions of syphilis are doubtless always present.

Demme's three cases (9) reported in 1879, were in children who probably had congenital lues.

Fraenkel's case (10) 1887 had extensive visceral syphilis.

Clarke's case (11) 1897 had multiple gummata.

Davis' case (1) 1910, had widespread involvement.

Thompson's case (12) 917 had a very marked nephritis.

Symptoms of disturbance of thyroid function are rare. Kohler's case (13) 1892 and Pospelow's (14) 1894, had symptoms of myxedema which cleared up with treatment.

Our second case had no marked symptoms of hypothyroidism but the basal metabolic rate was minus 36

None of the recorded cases of true gummata showed unquestionable symptoms of hyperthyroidism. Thompson's case (12) had a pulse rate of 140, slight protrusion of the eyes and had lost 50 pounds in weight but he had advanced degeneration of the cardiovascular system and the kidneys.

We examined the tumor in the second case through a wide exploratory incision. The subcutaneous tissue was not involved but was quite oedematous. The pregladular muscles were densely infiltrated and could not be separated from the tumor. The larynx was firmly molded in the tumor which had extended across the isthmus into a small part of the right lobe; the left lobe of the gland had apparently been entirely replaced by the tumor mass which was the size of an orange. The tumor was grayish in color, friable and very hard, and bloodless. Microscopically it showed typical gummatous tissue.

From the clinical picture and the appearance at operation we have no doubt that it originated in the thyroid.

The treatment should consist of mercury salivarian, and large doses of iodide. The prognosis is good.

#### CONCLUSIONS

The following conclusions summarize the cases reported:

1. Gumma of the thyroid is a rare lesion of syphilis.

2. Women are affected more frequently than men (14 of 21 cases).

3. It may result from both hereditary and acquired syphilis.

4. The symptoms are those of mechanical interference from the tumor. As a rule there is no disturbance of thyroid function. When present it is usually myxedema, rarely hyperthyroidism.

5. The prognosis with active treatment is good.

6. The appearance of the tumor may lead to confusion with cancer.

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## THE GIANT-CELL TUMOR OF BONE AND THE SPECTER OF THE METASTASIZING GIANT-CELL TUMOR

B. JOSIPH COLT BLOODGOOD M.D. F.A.C.S. BALTIMORE

**T**HANKS to Codman's registry I am able to add almost 100 cases to the number which I have recorded and studied since 1893—in all 177 cases, not including some 12 examples of the giant-cell tumor of the jaw.

The contribution of Ewing and Stone and the literature appearing since 1899 which was not discussed by them has been reviewed.

*The metastasizing giant-cell tumor.* This has not been proved. Ewing and Stone could not find any evidence from the study of the literature, nor have they observed such a metastasizing tumor in their own experience.

From the very beginning of my studies of cases and literature which were first published in the December numbers of *Progressive Medicine* in 1899 I have followed carefully the literature and have gradually accumulated more than 1,000 cases of bone tumor and I have never been able to prove that the benign type of the giant-cell tumor metastasizes.

*Malignant giant-cell tumor.* Almost every surgical pathologist or pathologist who has studied bone tumors and who has recognized the benign group, first isolated by Lebert in 1830 and called *myeloid tumor* and again clearly pictured in 1853 by Paget in his *Surgical Pathology* has feared or described a bone tumor as chiefly a giant-cell tumor but containing cells which were histologically suggestive of malignancy.

It impresses me therefore as of great importance to present my evidence which is, that for practical purposes one need not fear a malignant giant cell tumor nor fear metastases from any typical giant-cell growth of bone.

As a matter of fact all tumors in which giant cells of the epulis type predominate do not metastasize and repeated local recurrences are rarely associated with a change to malignancy.

Ewing and Stone are rather of the opinion that their case was primarily a benign giant

cell tumor in the upper head of the tibia, and that the change to malignancy followed in complete curetting and the irritation of infection and radium on the recurrent tumor.

However there might be some dispute as to whether the primary tumor was of the benign giant-cell tumor type. Francis Carter Wood who examined the sections first was very suspicious of malignancy.

*Recurrence in the benign giant-cell tumor.* Of the 177 cases which I have studied, there is not a single example of death from metastasis, and in 100 cases it is from 3 to 30 years since the patient was first treated. As the average age of patients having benign giant-cell tumor is between 20 and 30 the majority of them is living today.

Of the 93 patients so far subjected to curetting operations 18 had recurrences and were subjected usually to amputation, a few to resection. In this group there was often more than one curetting, in a few there was evidence of infection and a few had radium introduced into the bone cavity. Yet in none of these cases was there any microscopic evidence of malignancy in the recurrent tumor when these sections came to final restudy. However many of the pathologists who studied first the sections of the recurrent tumors, expressed the written opinion that they were malignant. Therefore in spite of recurrence and in a certain number of cases of a diagnosis of malignancy none of them in which ultimately the tumor was completely removed by resection or amputation died of metastases.

The observation therefore of Ewing and Stone of recurrence and metastases after curetting and of ultimate death after amputation is unique if the original tumor when submitted to the registry is accepted—one of the benign giant-cell type.

Of the 75 cases ultimately cured by curetting, in some 6 or 7 there has been more than one curetting, and yet, the patients have remained well years. I have reported an ex-



Fig. (at left) Pathol. N. 3600. Low power. Typical giant cell tumor. The fibrous tissue to the right is the scar of an exploratory operation in which the bone shell was removed. Yet the tumor had remained circumscribed.

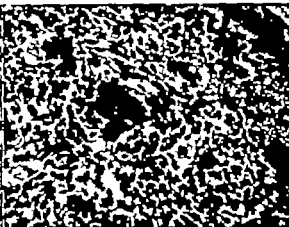


Fig. Pathol. No. 3600p. High power of area in Figure 1. Giant cells of the epithelioid type embedded in the typical cellular stroma, some free blood, few definite capillaries.

ample in which the tumor in the lower end of the radius was twice curetted incompletely, then incompletely resected. Eighteen months after the first operation and some 6 months after the last I removed an encapsulated giant cell tumor in the defect left by the removal of the lower end of the radius, and transplanted bone. This patient lived some 12 years without recurrence and with good function of the wrist.

Therefore I have records of some 24 cases in which recurrence has taken place after curetting in which the patients have not died of metastasis.

*The cause of recurrence after curetting.* I cannot find the cause in any change that can be recognized in the gross local growth or in the histology. Recurrences have taken place when the X-ray and operative evidence indicated an intact bone shell. Permanent cures have been obtained by curetting alone when the X-ray and operative evidence disclosed one or more perforations of the bone shell or even complete destruction of the bone shell.

If one mixes the section of the tumors which have not recurred after curetting with those that have, there are no distinguishing points with either the low or the high power. Pre-operative and postoperative X-ray, radium or roentgen treatment have not prevented recur-

rences. The only cause for a recurrence seems to be some faulty technique in the operation. Yet, this is not absolutely proved because some cases incompletely curetted have not recurred.

Personally I have curetted 6 cases. In every one the curetting was thorough and in those situated in the upper end of the tibia (5 cases) the operation was made bloodless by a rubber band; the one in the upper end of the humerus was done without constriction. In the early cases the bone cavity was swabbed with pure carbolic acid followed by alcohol. Later cases, in addition, were cauterized with 50 per cent zinc chloride and in the most recent operations the curetting was done with the electric cautery. Some of the wounds have been packed, others have been closed. In all of them however infection was prevented.

My evidence therefore suggests that if curetting is done, it should be thorough and if possible bloodless. The bone shell should be cauterized with pure carbolic followed by alcohol, packed for a few minutes with a piece of gauze saturated with 50 per cent zinc chloride and I am inclined to think the curetting should be done with the electric cautery.

As I read the operative notes of the cases in which recurrence has taken place I get the impression that the tumor was incom-



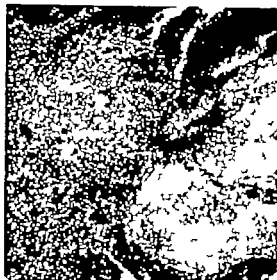
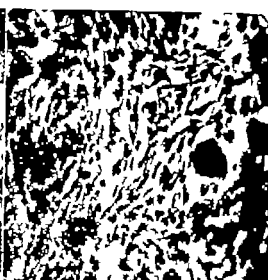


Fig 3 (at left) Pathol No 7496 Low power Typical giant cell tumor area at right osseous fibrocystics above



in Figure 3 Giant cells of epulis type Stroma contains more spindle cells, more eosin staining intercellular substance and less blood than in Figure

pletely removed, and thermal or chemical cauterization was not employed

In a second report I propose to give in greater detail the results of the study of these 177 cases, taking up the question of treatment

with X rays, radium, and the toxins, and discussing whether X-rays and radium should be the first treatment of choice, or whether operation should be considered first The illustrations, Figures 1 to 12 are the most im

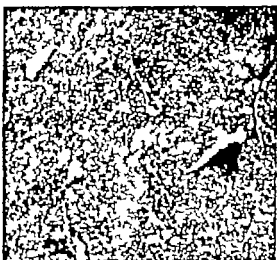


Fig 5 (at left) Pathol No 700 Low power Giant cells not as distinct as in Figure 3 less osseous fibrous than in Figure 3

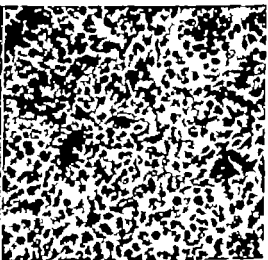


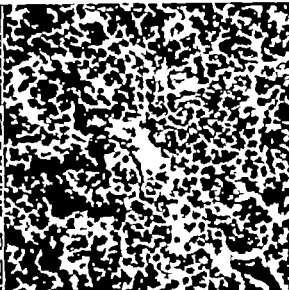
Figure 5 Compare giant cells with those in Figures 3 and 4 Morphology of round cells in each giant cell are embedded more suggestive of sarcoma than Figures 3 and 4

Fig 6 Pathol No 8700 High power of area shown in



Fig 7 (at left) Pathol. N. 2679. Low power. The predominant giant cell in cellular tissue mixed with hemorrhage resembles the benign giant-cell tumor.

Fig 8 Pathol. No. 2679. High power of area shown in Figure 7. Very cellular, no typical giant cells. Eight pathologists diagnosed this sarcoma, 1 diagnosed an ant of the giant-cell tumor. This tumor occupied the upper



epiphyses of the humerus with bone shell intact. It was curetted in October, 1920, by Dr. Bonta, of Cleveland. There followed chemical disinfection, radium, X rays, Coley's serum. In April, 1924, the patient is reported as well and there is no evidence of local recurrence or general metastases. See Figures 9 and 10 for high power of areas.

portant part of this paper. They picture the common benign giant-cell tumor, the variant of the giant-cell tumor, and a sarcoma which a few pathologists look upon as an extreme variant.

*Microscopic picture of the giant-cell tumor and its variants.* In the previous pages I have tried to emphasize two facts which appear in the literature since Lebert, Paget, and Nélaton, and are found in the original records of the 177 cases which I have just restudied.

The first fact is that with regard to the metastasizing giant-cell tumor my conclusion agrees with that of Ewing and Stone, and up to the present time no case has been observed which can be confirmed by restudy.

The second fact is that there is a variability especially in high-power pictures, in size and morphology of the cellular tissue in which the giant cells of the epulis type are embedded.

When all giant-cell tumors were looked upon by the majority of pathologists as sarcoma and not separated as Lebert, Paget, and Nélaton did, little attention was paid to the morphology of the cells in which the giant cells

were embedded, because when considered malignant i.e. sarcoma what difference did it make? But later as other observers began to agree with Lebert, Paget, and Nélaton the common typical giant-cell tumor was recognized and placed in a group by itself. But every now and then a tumor central in bone with and without an intact bone shell suggesting the giant-cell tumor in the gross and very like the giant-cell tumor under the low power of the microscope presented under the high power a cellular tissue surrounding the giant cells of such an unusual appearance that the diagnosis of sarcoma containing giant cells of the epulis type was made. Yet when these patients are followed we have yet to observe metastasis, and when the cases are subjected to the registry there is a difference of opinion among the pathologists examining the same sections.

*Microscopic illustrations.* Figures 2 to 7 picture the low and high powers of the typical giant-cell tumor about which there has been no disagreement among the pathologists. Figures 8 to 11 picture a case which might be

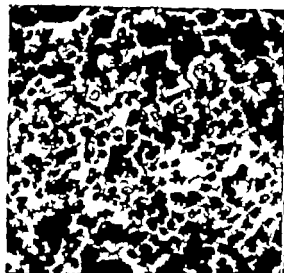


Fig. 9 (at left) Pathol. No. 26792. High power. Not giant cells of the epulis type in cellular stroma suggest sarcoma. For legend see Figure 8.

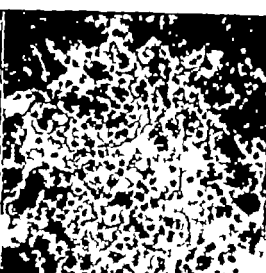


Fig. 10 (at right) Pathol. No. 26792. High power. Note the cartilage cells in tumor area similar to Figure 8. For legend see Figure 8.

called, if there be such a thing a malignant giant-cell tumor or a sarcoma containing giant cells of the epulis type. On the interpretation of these sections there is disagreement and as noted in the legends, this patient has remained well now 3 years since the curetting of the tumor in the upper end of the humerus.

As we rarely see metastasis in sarcoma of bone after the third year the chances are good that this patient will remain well.

Figures 12 and 13, in the opinion of eight pathologists with whom I agree present a histological picture entirely different from the giant cell tumor and resemble the typical osteogenic sarcoma. In it there are no giant cells of the epulis type. Yet, two pathologists have expressed the view that it is a variant of the giant-cell tumor and one that it is chronic inflammation. The patient is well 10 years after amputation.

*Is there a central sarcoma with intact bone shell?* The more I restudy my own cases the more I exclude true sarcoma from this group.

In the *Annals of Surgery* for August 1900 I reported three cases of the so-called bone aneurism (malignant haemorrhagic bone cyst) and gave the literature. In the first case (loc

cit. Fig. 39) Dr. Finney first operated in 1905 and did not expose the tumor until he had passed through a bone shell. The cavity contained blood and was lined with friable haemorrhagic tumor tissue resembling the giant cell tumor. The sections which I examined showed no giant cell of the epulis type but an ordinary sarcoma, not unlike the osteogenic type. There was recurrence and an amputation in 3 months followed by death in 1 year due to metastasis. The sections exclude a giant-cell tumor. However the photograph of the specimen after amputation shows a bone shell thicker and more worn than that seen in the giant cell tumor.

The second case (loc cit. Figs. 40 and 41) may have been a periosteal tumor—one could not tell. There was a huge cavity with the head of the humerus above and a bit of the shaft below. Between these two points the shaft was destroyed. In the third case (loc cit. Figs. 42 and 43) the haemorrhagic cyst was outside the shaft of the humerus.

So of these three cases of bone aneurism all of which are macroscopically sarcoma and all of which were fatal because of metastases there was only one which could have been confused with a central giant cell tumor with intact bone shell.

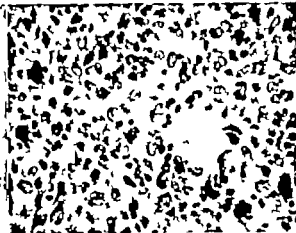


Fig. (left) Pathol. No. 14220. Low power. Compare with Figures 3, 5 and 7. Hemorrhage predominates in the picture. There are many nucleated cells suggesting typical giant cells. For high power see Figure 4. Pathol. No. 420. High power. Typical giant cells of the epulis type. Large multinuclear cells. Reported by Bloodgood in the

*Journal of Radiology* March, 1920 (Figures 20 and 21) as an example of malignant hemorrhagic cyst—a sarcoma. In Codman's Registry (No. 66) the pathologists agree as to sarcoma, but favor a variant of the giant cell tumor, one chronic inflammation. The tumor occupied the lower end of the femur. The patient is living and free from recurrence—ears since amputation aged 7.

Ten years later in the *Journal of Radiology* for 1920 I classed as central sarcoma 25 cases. Two of these diagnosed malignant bone cysts, I now retract. One on restudy proved to be a giant-cell tumor and the patient is living 5 years after the amputation. The other patient with a latent bone cyst (ostitis fibrocystica) is living 7 years after the amputation. Then, there is a third malignant bone cyst which two of my colleagues look upon as a variant of the giant-cell tumor reported in this paper in Figures 11 and 12.

This leaves but 5 malignant bone cysts and as 4 of these had periosteal involvement, they must be excluded.

On restudy the 11 examples of central sarcoma of the very cellular type all of which can be restudied from the gross and X-ray picture are found to be bone tumors with both periosteal and central involvement.

The only true central sarcoma with intact bone shell reported in that journal of which we have had examples since are either chondrosarcomata or myxosarcomata which present an entirely different gross and microscopic picture from that of the giant-cell tumor.

#### CONCLUSIONS

On careful reinvestigation of all of my material I am unable to find a central lesion with an intact bone shell which resembles the giant cell tumor in the gross and more or less microscopically that has not remained free from metastases. Many of them are free of recurrence after curetting. Therefore at the present time if a surgeon explores a central bone tumor in which the X-ray palpation and exploration exclude tumor tissue outside the bone shell or the capsule about the bone shell is destroyed he can be certain that the only possible sarcoma is one resembling in the gross and in the section the osteogenic sarcoma of the chondromyxoma type—a tumor easily to be distinguished from the giant-cell tumor or ostitis fibrocystica. If this statement is true it simplifies the diagnosis because the cellular pathology of the giant-cell tumor in a certain percentage of cases especially under the high power has been confusing to experienced pathologists, and even today is incorrectly diagnosed sarcoma leading to unnecessary amputation or mutilating resections. The mutilation is especially great when the resection is done in the jaw.

## PAPILLARY EPITHELIOMA OF THE KIDNEY PELVIS

REPORT OF A CASE

By EVERETT E. ANGLE, M.D. New York

THE literature shows that papillary tumors are seldom found in the pelvis of the kidney or in the ureters, although they are common among lesions of the bladder.

Watson and Cunningham found only one lesion in diagnosing 94 cases of renal and perirenal tumors collected at the Boston hospitals during a period of 10 years.

Albarran found 43 cases of pelvic renal tumor reported in the literature up to 1900. 18 of these were papillomata.

In May 1919 E. S. Judd reported an interesting case but the preoperative diagnosis was surgical left kidney. Pyelography was not being done at that time.

In the *Lyon Medical* November 25, 1920 a case of epithelioma of the kidney was described. Painful hematuria was the only symptom. Even when the kidney was exposed the diagnosis was dubious until after exploratory nephrotomy.

Wilson in 1912 reported three papillomata and according to Brunsch only five had thus far been noted at the Mayo Clinic. McCown in a recent publication reviewed the entire literature and found only 10 cases reported by American authors and 38 from foreign countries.

Kretschmer mentioned 2 cases and Stevens Hyman and Goldstein each mentioned personal experience with one.

In November 1921 Miller and Herbert reported one more case of papillary tumor of the renal pelvis, but theirs was one of the first cases to be diagnosed correctly before operation and the diagnosis was aided by a pyelogram with thorium solution. The pyelogram showed a large filling defect and the tumor filled to bulging the renal pelvis.

**Pathology.** Lwing in his book on neoplastic diseases says that epithelial tumors of the renal pelvis take one of three forms: first that of a benign papilloma which may affect any portion of the renal pelvis or ureter; second

that of a papillary epithelioma; and third that of an alveolar carcinoma. His description of the second form fits our case very nicely. He says: "Papillary epithelioma shows overgrowth of the cell layers of benign papilloma, atypical cell forms and infiltrating qualities. In infiltrating tumors the papillar structure is soon lost and the growth is alveolar or diffuse or scirrhous."

The transformation of benign into malignant papilloma has been made clear by Albarran. In Battle's case simple papilloma cured from the pelvis soon recurred with malignant structure. Pantaloni observed a recurrence in malignant form in the scar after nephrectomy for a uniformly benign papilloma. In portions of chiefly benign papillomata, especially at the base, atypical overgrowth is sometimes observed. The long duration of symptoms preceding the discovery of a malignant papilloma suggests the development of a slowly growing benign tumor followed by malignant transformation.

A report of our case may be of interest.

An English Jew, age 60, entered the hospital October 18, complaining of bloody urine. His family history is not remarkable and his past history shows him to be man of exceptionally good health.

**History of hematuria.** The present illness began years ago. 1st blood colored urine passed painlessly. Since this time he has had intermittent attacks of hematuria. Occasionally when he voids there could be few drops of blood at the beginning of the stream but most often the blood urine is terminal in type. For the past few weeks he has noticed the presence of three or four strings of such he voids at the end of micturition.

On being questioned as to the presence of pain the patient states that he has observed very slight pain the left lumbar region during the past month. He has had no dysuria frequently or diminution of the urinary stream. His appetite good. He has not lost weight or strength. He works as a solely on the solicitations of his family. He has become alarmed over his condition.

**Physical examination.** Physical examination reveals fairly well developed and robust man. He is somewhat anemic but not acutely ill.

The head is negative to external examination. The pupils are equal, regular, and react to light and distance. The mucous membrane is clear but of lessened tissue content. There is no adenopathy. The chest is well developed. The lung fields are clear. The heart is not enlarged. Sounds are regular and of good quality.

The abdomen is slightly protuberant, soft and tympanic throughout. No spasm, masses, or tenderness are found. Kidney not felt, bladder is not distended. No hernia is present.

Penis and scrotal contents are normal. Prostate is not enlarged. Seminal vesicles are not felt. Extremities are normal. Reflexes are active throughout.

**Cystoscopic examination.** After the usual preparation, 1% Butyn 1 per cent, used for local anesthetic action, the instrument was passed without difficulty. The interior of the bladder was searched carefully but no evidence of tumor was discovered. The fundus is slightly trabeculated and there was a little overgrowth of the post trigonal region. This tissue did not resemble in any sense of the word a tumor. The cervical trigone was normal in appearance. The ureteral orifices were normal in size, location, and appearance. The vesical orifice was interesting in that there was a moderate intrusion of the subcervical group on the floor of the bladder neck. This was easily traumatized and bled.

Lead catheters No. 6 French passed to the kidney pelvis on each side without obstruction. Clear fluid appeared on the right, hazy on the left. The report of the ureteral specimens was as follows:

	Right	Left
Amount	8 cm in 10 min	10 cm in 10 min
Urea	8 gms per liter	9 gms
Phenol	5 min appearing time	1 min
Sulphone	8 per cent in 10 min	1 per cent in 10 min
Phthalein	Rat pus in clumps	Epithelium no pus
Culture reports,	neg	Pyelogram is alive

The urine showed a faint trace of albumin and few red blood corpuscles, nothing else. The fifth day output was 25 per cent the first hour and 5 per cent the second. The blood chemistry taken the following day showed a urea nitrogen of 5.9 milligrams per 100 cubic centimeters, a sugar of 60 per cent and carbon dioxide plasma combining power of 60.5 volumes per cent.

The X-ray examination of the genit urinary tract before and after injection showed catheters introduced into both ureters to renal pelvis. The right kidney, as normal in size, shape and position. Injection of the left kidney revealed dilated pelvis with irregular outline of the lower pole suggesting growth in pelvis.

**Operation.** After considering this data, an operation was decided upon October 30 with the patient under gas-oxygen anesthetic. Dr. Lowder exposed the left kidney with an incision extending from the costovertebral angle to just above the crest of the ilium.



Fig. Pyelogram of left kidney

The kidney fat was entered by blunt dissection and the kidney palpated. No increase in size was made out. On delivery of the kidney into the wound there was noted an increase in the lobulations at the lower pole with an increased vascularity in one small area, no larger than 1 centimeter in diameter. On careful palpation of this area an increased sense of resistance was noted. No definite tumor could be made out.

**Cystoscopic findings.** What was to be done. The operative findings would certainly stagger any surgeon unless he knew the pre-operative findings and knew that he could rely on them.

The kidney was removed. The ureter was tied at a distance of 8 centimeters from the pelvis and the wound was closed in the usual manner with a cigarette drain placed at the site of the kidney. Those at the operation were too curious to find what pathology the kidney showed to wait for the pathologist, and opened it once and found a growth involving the pelvis. The pathological report came back as carcinoma of the pelvis of the kidney.

The entire growth was no larger than a dollar. Sections of the reter examined macroscopically showed no evidence of involvement.

**Convalescence.** The patient was sent back to the ward in excellent condition. His cystolic blood pressure did not go below 120 and there were no signs of shock. He made an uneventful convalescence and left the hospital apparently cured. In view of the pathologist's report he has returned for several applications of radium.

When last seen 8 months after the operation he was feeling well and working. X-rays taken of his skeleton showed no evidence of metastases.

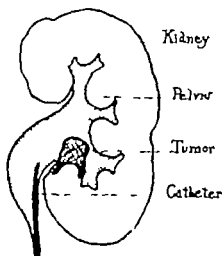


Fig. 2. Diagram of pyelogram.

## SUMMARY

To summarize then we have a patient who has had hematuria for 2 years. Hematuria is his presenting symptom and his only symptom. The physical examination is negative but the urological investigation gives a clear cut picture. The right kidney doing most of the work of purifying the blood. Phthalein appears in 5 minutes on the right and 8 per cent is excreted while on the left it appears only after 12 minutes and 1 per cent is excreted. In addition to these facts the pyelogram shows a filling defect in the pelvis of the kidney.



Fig. 3. Photomicrograph of the tumor.

In other words modern urology gives us the means of making an early diagnosis of tumor of the kidney. We are agreed that early diagnosis and radical surgical treatment combined with radiations give the best hope of success in treating cancer where the kidney is involved.

## ENDOCRINE DISTURBANCES AND NON-UNION OF FRACTURES

## EXPERIMENTAL STUDY

By ANATOLE KOLODNY M.D. CHICAGO

College of Medicine University of Illinois

THE time has passed when the physician taking care of the patient is held responsible for non union of fractures. The most skillful surgeon can be unfortunate enough to list among his patients one with an ununited fracture. What then are the causes of non-union? The theories most frequently advanced regarding the etiology are interposition of soft tissues displacement of bone fragments scars of the soft tissues surrounding the fractured bone ends deficient immobilization and finally the so-called pathological constitution of the tissues originating from the mesoderm. Numerous as they are they are nevertheless unsatisfactory in the explanation of all cases of non-union. There are cases of non-union which according to Bier mock all theories. This perhaps is the reason why Bier offers the theory of local hormone stimulation of the bone producing elements in traumatic bone injuries. It is not difficult to see that these numerous theories are all based upon the element of local disturbance in other words they localize the etiological factors at the seat of the fracture.

It has always seemed to me that the opinion that non-union of fractures is a result of an exclusively limited local disturbance is wrong. The question has presented itself to me what role, if any do the frequent endocrine disturbances play in the healing of fractures? In an attempt to answer the question I have carried out experimental investigations on the testes, the pancreas, and the thyroid. The results of this work are given in the following report.

All of my work has been done on dogs. Twenty-eight experiments were performed on 28 dogs, not counting the controls. I have always tried to secure controls of as nearly as possible the same age as the experimental animals. Of the twenty-eight experiments

nine were to demonstrate the relationship between the disturbances of testicular secretion and healing of fractures eight for the pancreas, and eleven for the thyroid.

*Testes.* It is a well known fact that the condition known as *pubertas praecox virilis* is accompanied by premature closing of the epiphyseal synarthrosis, and that in genital hypoplasia or so-called late maturity we see an increase in height especially in the length of the legs due to a late closing of the epiphyses. Evidently this fact has long been known to farmers who increase the size of roosters and pigs by castration. The relationship between secretion of the sexual glands and the development of the skeleton has been recently demonstrated by Steinach whose feminized and masculinized rats developed a skeleton resembling that of the opposite sex. This relationship is also shown in cases met with in clinical practice. These cases, still seldom recognized belong to the so-called Froelich syndrome. Three instances observed in Dr. Steindler's service in the Iowa State University Hospital in 2 years showed cox vara accompanied by prominent obesity small penis and testicles. Notwithstanding this relationship we did not find in the literature anything dealing with the question of the influence of testicular secretion upon the healing of a fractured bone.

Among the animals chosen for the investigation of this question were five puppies between 5 and 8 weeks old and four adult dogs. The experiments in this series were conducted as follows. The animal was castrated. Three weeks after the operation I produced a closed fracture of both bones of the left forearm. The fractured limb was immobilized. X ray examinations were made 14, 21 and 28 days after the fracture. Before the X ray examination the cast was removed to obtain a clearer picture and replaced immediately after exposure.

I do not speak here about the spontaneous pseudarthrosis in bone joints and about pathological bone fractures.





Fig. 2 Normal adult dog Closed fracture 14 days post fracture  
Fig. Same fracture as that shown in Figure 21 days post fracture  
Fig. 3 Same fracture as that shown in Figure 28 days post fracture

One puppy died of bronchopneumonia 8 days after the fracture was produced. There was no evident abnormality in the healing process of the fractures of the castrated adult dogs when compared with a normal adult dog. But in none of the four castrated puppies did healing of the fracture occur by the twenty eighth day. In two of them there were no signs of beginning callus formation. Compare Figures 4 and 5.

We see clearly that normal testicular secretion is indispensable for healing of fractures in animals which have not reached maturity and is not essential in adult animals.

**Pancreas** The relationship between pancreatic disturbances and pathological conditions of the skeleton is barely mentioned in the literature. Dodds, quoting Hodgson and Stroeltzner suggests that there is a lesion of the pancreas in rickets and that this problematical lesion leads to poor production of fatty acids and poor absorption of calcium.

I attempted to clear up the relationship between pancreatic disturbances and healing of fractures by means of eight experiments on eight adult dogs. Each experiment consisted of the following. A laparotomy was done, the whole left ramus of the pancreas (cauda pancreatica) and the portion of the inferior



Fig. 4 Castrated puppy Closed fracture 28 day post fracture  
Fig. 5 Not castrated puppy Closed fracture 28 days post fracture

transverse ramus (caput pancreatis) which is not adherent to the duodenal wall were removed. The remaining portion represented about one sixth of the entire pancreas. This portion was always sufficient to prevent diabetes in the dog, as far as we could judge by the available methods of examination (urine analysis and sugar tolerance test). We considered the avoiding of diabetes in the dogs to be most important in our investigation, since diabetes interferes with all regenerative processes of the organism. Four weeks after the pancreatectomy all clinical signs of the laparotomy having long before disappeared we produced a closed fracture of one or both bones of the left forearm of the dog. The limb was immobilized. X-ray examination was made after 14, 28 and 42 days, when finally the animal was sacrificed.

Figures 1, 2 and 3 of this paper show the healing of a closed fracture of both bones of the left forearm of a normal adult dog. Figure 3, made 28 days after fracture shows a complete consolidation of the callus and a completed healing of the fractured forearm in a normal dog. In our pancreatectomized dogs the formation of callus was markedly postponed and there was no healing of the fractures even after 42 days. Figures 6, 7 and 8 show the respective final results of several of those cases.

A fracture of one bone of the forearm more convenient for immobilization of the limb.



Fig. 6. Partial pancreatectomy. Closed fracture 42 days post fracture.

Fig. 7. Same fracture as that shown in Figure 6. Blood vessels injected 42 days post fracture.

We see therefore that pancreatic disturbances even such as cannot be recognized by all our laboratory tests and methods interfere with healing of fractures.

**Thyroid.** Some time ago thyroid extract was used in the treatment of delayed union of fractures, but its use was based upon empirical grounds only. I have not found anything in the literature dealing with the question of the relationship between thyroid disturbances and bone regeneration. On the contrary we find a relatively rich literature on the influence of the parathyroids upon calcium assimilation. McCallum and Erdheim both proved that deficiency of the parathyroids leads to deficiency of calcium in the organism and to tetany.

For the investigation of the relationship between thyroid disturbances and healing of fractures I used eleven adult dogs. In five of them we removed the whole thyroid gland and in the remaining six only one lobe and two-thirds of the other lobe were removed. The thyroidectomy was intracapsular so as to avoid the possibility of traumatization of the parathyroids, which in dogs lie behind the upper poles of the thyroid extracapsular. We have been forced to omit the basal metabolism test on account of technical difficulties, but Kottman's test showed a prominent hypothyroidism even in the cases where a part of the thyroid had been left. All the animals showed a prominent obesity at the end of the experiment. Four weeks after the operation a closed fracture of the forearm was produced. The limb was immobilized. X-ray examinations were made after 14, 21, 28, and 42 days.

Funkel Zacher (Pach) 1931



Fig. 8. Partial pancreatectomy. Closed fracture blood vessels injected 42 days post fracture.

Figures 9, 10, and 12 show that normal union has not taken place 42 days after fracture. Figures 7, 8, 11, and 12 show the evanescence of the intra-ossal blood vessels in the fractured bones. This is the fracture hyperemia which in dogs normally subsides about the 25th day after fracture and which still persists in our animals with endocrine disturbances after the 42nd day.

From Figures 9, 10, 11, and 12 we see that a normal thyroid function is absolutely essential for the healing of fractures.

#### DISCUSSION

Our experiments of the first series prove that normal testicular secretion is essential for regeneration of bone in animals which have not yet reached maturity and that it is of no demonstrable importance for regeneration of bone in adult dogs. We realize that laboratory captivity itself influences the development of young puppies so that probably not the whole effect can be ascribed to castration but still our experiments proved beyond any doubt that testicular disturbances are of very serious consequence in the healing of fractures in young animals.

The question of fracture hyperemia I doubt, it is in my paper "The role of the paravascular blood supply in union of fractures." *Annals of Surgery*, J. Bone & Joint Surg. 42, October, 1950.



Fig. 9. Complete thyroidectomy. Closed fracture of the radius 42 days post fracture.

Fig. 10. Same fracture as that shown in Figure 9. 42 days post fracture.

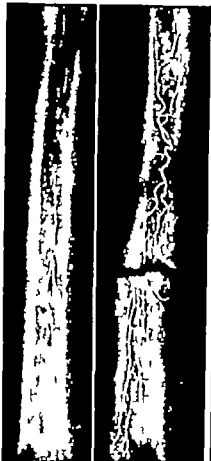


Fig. 13. Complete thyroidectomy. Closed fracture of the left radius. Blood vessels injected. The right radius for comparison. 42 days post fracture.

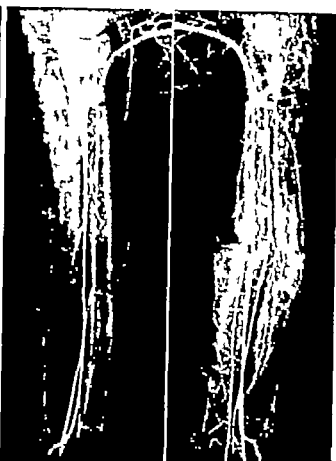


Fig. 14. Complete thyroidectomy. Closed fracture of the left forearm. Blood vessels injected. The right forearm for comparison. 42 days post fracture.

As far as the experiments on the pancreas are concerned it can be argued that the partial pancreatectomy produced malnutrition in the animals and led indirectly to non union of the fractures. That such an argument is ill founded we see from the fact that all our pancreatectomized animals gained in weight during the experimental period and the urine examination and sugar tolerance test were negative for diabetes.

We would like to emphasize again that in all our thyroidectomized dogs the parathyroids were left intact in the body as was proved at necropsy.

It is advisable to make clear one more point. As has been mentioned above, the

animals in the two last series of experiments were kept for a period of 6 weeks after the production of the fracture. We know that this period of time is sufficient to enable us to judge the results because in normal adult dogs a fracture of the bones of a forearm will heal in less than 28 days. Figures 3 and 14 also show that 42 days were sufficient in our cases. Union cannot be expected where we have a formation between the bone fragments of a dense fibrous septum with beginning cleavage. The cartilaginous septum (Fig 14) still persisting in the callus 42 days post fracture is also the best evidence of delayed union.

The results of our experiments prove beyond any reasonable doubt that endocrine



Fig. 3 Section through the fibrous septum between the fractured bone ends.

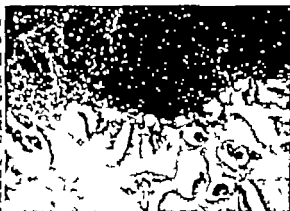


Fig. 4 Section through the cartilaginous septum between the fractured bone ends.

disturbances play a prominent rôle in the suppression of regenerative processes of bone. We are far from insisting that these endocrine disturbances influence bone regeneration alone. But from our results we must conclude that among the other effects of endocrine disturbances is the suppression of healing of fractures. On the other hand we do not think that all cases of delayed union or non-union of fractures are to be attributed to endocrine disturbances. Nevertheless in a num-

ber of cases the cause of non union is endocrine disturbance.

Further we do not pretend to have made an exhaustive investigation of this problem. For example we did not touch upon other endocrine glands, as the adrenals and the hypophysis, nor did we control our experimental animals by means of organotherapy. We believe however that our results will attract the attention of the surgeon to this aspect of the old question of non-union of fractures.

## BREAST HYPERTROPHY—NON-SURGICAL BREAST CONDITIONS

B. EDWIN I. BARTLETT, M.D., F.A.C.S., SAN FRANCISCO, CALIFORNIA  
 From the Division of Surgical Pathology, Department of Surgery, University of California

**B**REAST hypertrophy is a local or general increase in the volume of the breast gland resulting from an increase in size or quantity of its constituents. Thirty or more terms have been invented to designate different histological or clinical phases of the same process, the best known of which are chronic cystic mastitis, senile parenchymatous hypertrophy, abnormal involution, Shimmelbusch's disease, cobblestone breast, lumpy breast, painful breast, etc. The expression breast hypertrophy is used as a group term in a purely clinical sense because all these conditions are curable without the aid of surgery and therefore form a natural group, and because of the histological pictures represented by the three-score or more names are found in breasts that are clinically normal and are only brought to the attention of the patient or physician when they are attended by clinical manifestations, such as lumps or tenderness. Other terms such as "lumpy breast" or "non-surgical breast conditions" are equally fitting, but hypertrophy is preferable in that it implies both a totally different process from tumors or infections and a totally different form of treatment.

In a statistical review of all the types of breast conditions treated in the University of California Hospital or in the out-patient department of the University of California Medical School, together with a restudy of the pathological material in the surgical pathology laboratory, there were collected 125 cases of breast hypertrophy. Sixty-eight were treated surgically and studied histologically. Among the latter sixteen were diagnosed as chronic cystic mastitis, nine as senile parenchymatous hypertrophy, nineteen as abnormal involution. The remainder were given miscellaneous diagnoses among which hypertrophy was the most common. All of the 125 cases were studied as a group from a variety of standpoints, but especially as regards their

identification by clinical means, their etiology and their treatment. The data upon which conclusion were based is shown in part in the accompanying tables.

In Table I-a the seven instances in the first and second decades have been classified as pre-puberty hypertrophy because they occurred just before that period. They have been included here because they differed from the normal puberty hypertrophy in that they were unilateral developments following trauma (Fig. 1). Three were in girls and four in boys. The male breasts were all excised except one while the female breasts were treated by protection. All are well. The chief complaint was tenderness, the mere contact of the clothing often being quite distressing. To palpation there was a mass corresponding in size to the areola which resembled in shape a button and very frequently was pronounced cystic by the inexperienced examiner. The microscopic slides in the three specimens studied showed the picture of puberty hypertrophy (Figs. 2 and 3). In the four instances treated expectantly the affected breast gradually lost its tenderness but the enlargement remained and with the development of the opposite breast at puberty no difference between the two could be made out.

In the eighth decade the one case is interesting in that it occurred in a male followed trauma, was extremely tender, was button-like and serous to palpation, and the microscopic picture was that of puberty hypertrophy.

On the whole, however, it appears that hypertrophy is a disorder of the ages 20 to 50 and more especially of the fourth and fifth decades. Marriage, pregnancy or lactation seems to have little or no bearing inasmuch as the ratio between instances of hypertrophy in single and married women is about equal.

Since this article went to press two other cases have been seen, one of which and the other in case of a girl. In both cases the history of trauma, especially in the case of the girl, was followed by a hard small object. These have not been studied and apparently are getting better without any treatment except rest and reassurance.

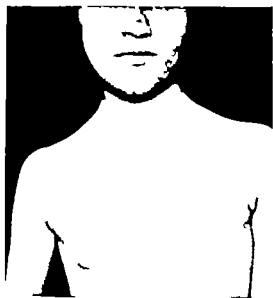


Fig. 3. Prepuberty hypertrophy. Female, age 13½. Trauma at 6 years of age followed by enlargement and tenderness. Under observation since 8 years of age. No change in this breast, no enlargement or tenderness in opposite breast. No indications of approaching puberty.

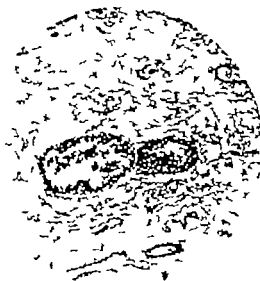


Fig. 4. S. P. 304. Prepuberty hypertrophy. Scattered parenchymatous structures in the form of dilated ducts. Ductal epithelium is being desquamated. (The solid cords of epithelium are becoming hollow tubes.) Alveolar structures are lacking. A great overgrowth of rather dense connective tissue of the interlobular type accounts for the palpable enlargement. The intralobular connective tissue has not become differentiated. Boy, age 13.

to the ratio between virgins and married women between the ages of 20 and 50. The same comparison holds true as regards virginity and pregnancy. It is also evident that hypertrophy is a condition of the active sexual cycle and not a senile perversion of normal atrophy.

In Table I b pain is shown to be a nearly constant factor while the unilateral and localized mass predominates in the proportion 5 to 3. The etiological factor when traceable was not primarily a localized affair since direct trauma was demonstrated but 30 times out of 91 the prepuberty hypertrophies being included. The most common factors were constipation and worry the latter of course being capable of leading to all kinds of physical upsets. Among the last 35 cases seen 25 gave evidence of a constitutional upset as a cause for the breast disturbance and in only three instances was there a history of an approaching menopause as the only factor.

In Table II-a and b the grouping or classification used was adopted for no other reason than that it was a convenient form of histological subdivision and was not based upon

the clinical picture the type of treatment employed and the ultimate outcome, because these are alike in all instances. In the study of the 68 cases in which histological material was available a participation on the part of all the elements making up the breast was demonstrable but, as a rule either the parenchyma or the connective tissue (Fig. 4) predominated. The parenchymatous type showed two distinct forms viz. the adenomatous, in which there was an increase in the number and size of the breast islands giving the picture quite like that of the early prefunctioning stage of lactation (Fig. 5, 6, 7) and the ectatic or dilatation type resembling the lactating breast in its various stages of involution (Fig. 8, 9, 10, 11, 12). Grossly the picture varied but there was always demonstrable one or more areas which contrasted sharply with the rest of the breast in that there was thickening or increased density or firmer consistency or presence of cysts. In cases where the whole gland was affected the quantity of non fatty breast substance was



Fig 3 S P 34 Similar to Figure except for more pronounced dilatation of ducts and absence of desquamated cells. Boy age



Fig 4 S P 3796 Connective tissue type. Virgin age 8. Tender lump (The space about the duct at the extreme right is an artifact)

very notably increased over that in the average breast. In the subdivision "without cysts" occasionally the ducts were very greatly distended with a creamy or soft

putty-like material which oozed forth upon section.

The figures show that the ectatic form of the parenchymatous type predominates, while the

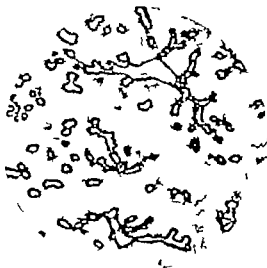


Fig 5 S P 384 Early or pre-dilatation hypertrophy. Ducts and alveoli increased. Number of breast lobules increased. Corresponding growth of intralobular connective tissue. Primipara. months pregnant. Pregnancy undisturbed.

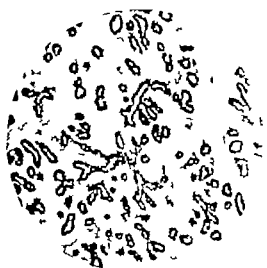


Fig 6 S P 307 Adenomatous type of breast hypertrophy simulating macroscopically pre-dilatation hypertrophy. Increase in number of ducts, of alveoli of breast lobules. Married woman never pregnant never lactated. Single questionable lump without symptoms.

TABLE I A—INCIDENCE OF HYPERTROPHY IN RELATION TO AGE SEXUAL CYCLE MARITAL STATE PREGNANCIES AND ETIOLOGICAL FACTORS

Age by decades	Number of Cases
First decade	
Second decade	6
Third decade	8
Fourth decade	39
Fifth decade	35
Sixth decade	9
Seventh decade	
Eighth decade	
Decade not known	4
Total	5
Sexual cycle	
Propriety	7
Propriety to menopause	23
After menopause	7
Cycle unknown	28
Marital state	
Single	5
Married	90
Before sexual maturity	7
State unknown	3
Pregnancy	
No pregnancy	36
With lactation	42
Without lactation	7
Unknown	4
Etiological factors	
Trauma	30
Worry mental load	3
Female trouble	9
Gastro-intestinal	37
No factor	4
Factor unknown	30

Among the etiological factors there is great overlapping. Concepts such as the most common feeling was very frequently combined with nervous or mental stress and most of the (traumatized) breasts had associated tender spots in women who were suffering from nervous, or digestive disturbances. Obesity or extreme disease as the only possible etiological factor was rare.

subdivision with large cysts (1 centimeter or over) is in the lead. This situation might be explained by the fact that cysts in the past have been considered surgical or that the cysts have been confused with solid tumors which require surgery. The nearly equal number in the group without large cysts however can be taken as an indication that there is actually a predominance of the ectatic type especially since there is no difference subjectively or objectively between this form and the pure adenomatous and connective tissue types. Furthermore the ectatic type

TABLE I B—SUBJECTIVE SYMPTOMS AND OBJECTIVE FINDINGS

Subjective symptoms	Number of Cases
Tenderness	5
Pain	
Pain and tenderness	42
None	6
Unknown	20
Total	5
Objective findings	
Unilateral	24
Bilateral	4
	5
General	5
Localized	73
	5

Pain or tenderness as present in 24 per cent of cases in which records of subjective symptoms were made (22.8 per cent were bilateral and 41.6 per cent were general). This means that the combination of pain or tenderness and multiple present in about 20 per cent of the hypertrophies.

predominates in the hypertrophies of the virginal breasts and in view of McFarland's monograph (1) the figures are interesting. Out of 68 cases which were studied histologically 15 were in unmarried women, and 11 showed ectasia while out of 9 instances in which the virginal state was admitted 6 breasts showed the ectatic type or residual lactation acini.

Table III records the type of histological picture in the breast proper where all or a portion of the gland was taken in the removal of the breast tumor. It shows that exactly the same histological pictures which have been demonstrated in the various hypertrophies were found in breasts that were normal clinically and grossly except for the presence of tumor. It is also interesting to note that no type of histological picture predominated in conjunction with either cancer or with benign tumor.

The tables which show the type of treatment and the ultimate result are not recorded because all the patients traced, with one or two exceptions, are free of subjective symptoms and consider themselves well regardless of the therapeutic agents employed. Among the non-operative some experienced disappearance of their lumps some saw a decrease in the size of the lumps or the whole glands while all became free of tenderness or pain. There has been a steady increase in the cases treated medically showing that with experience more and more can be recognized



TABLE II-A AND II B—HISTOLOGICAL PICTURES IN SIXTY EIGHT CASES OF BREAST HYPERTROPHY

	Total No. Cases	With large cysts	With large epithel.	Connective tissue	Adenomatous	Fatty	Mixed
1st decade							
2nd decade							
3rd decade	6		3				
4th decade	20		4	4			
5th decade		3	0				
6th decade	4		4				
7th decade							
8th decade							
Total	49	30	30	8	5		3
Married	48	30	14	4	7		
Single	5	5	0				
?	3						
Prepub.	35	6	9	5	4		
Pub. Meno	5						
Post Meno	30	0	9	3	5		3
N. Preg.	5		5	3	5		
Lactation	7	7	6				
Without L.	3						
	24	8	8	3	3		
Unilateral	53	27	5	7	6		3
Bilateral	5	4	5		4		
General	20		7	4	4		
Local	48	24	3	4	0		
Pain	20	2			2		
Tenderness	9	5	5	5	3		
?	30	8	5	3			

Table showing the relative frequency of the three main types of hypertrophy. The adenomatous type resembles macroscopically the hypercystic hyperplasia which largest at menopause and sometimes until the climacteric, especially the ectatic type with or without large cysts (small but numerous and the hypertrophic breast or adenomatous type). The connective tissue type shows an overgrowth of the interlobular connective tissue associated with marked relative diminution in secretory elements.

TABLE III—STUDY OF THE BREAST PROPER IN 163 CASES OUT OF 300 OPERATED UPON FOR BREAST TUMOR

	Benign	Malignant
Normal breast		9
Atrophy	7	50
Hypertrophy—connective tissue		7
Adenomatous	7	
Ectatic with large cysts		5
Ectatic without large cysts	6	44
Mixed		4

This table refers to the macroscopic picture only and does not mean that there was gross hypertrophy by its nature in the breasts removed, which were sometimes the case, but usually very different from what may be considered normal and not suspected until the disease was studied under the microscope. The word "malignant" suggests that gross pathological and subjective symptoms are the only differences between the normal breast and the case in which the disease is noted under the hypertrophy.

by their clinical manifestations alone. Thus among the first 50 cases 46 were operated upon either for the purpose of making a diagnosis or on a mistaken diagnosis while among the second 50 16 were operated upon and out of the last 20 only 1 came to surgery.

## DIFFERENTIAL DIAGNOSIS

Differential diagnosis is based upon four points, viz. pain, multiplicity, position of the lump, and shape of the lump.

1. *Pain*—When the patient comes to the physician on account of pain he may rightly suspect that the condition is benign, especially if the pain is the initial symptom and the predominating factor. Hypertrophies and benign tumors are very frequently tender or even painful while cancer is never tender except in the presence of ulceration, and is painful only in the later stages when the positive signs of malignancy are present. The pain or tenderness of hypertrophies or of the benign tumors cannot be accurately differentiated but a hypertrophy usually gives constant tenderness, sometimes varying in degree from day to day while benign tumors are more likely to be painful or tender only at the periods. In approximately 90 per cent of the hypertrophies the chief complaint was tenderness in at least one of the areas of thickening while former studies have shown that pain or tenderness is present in about 50 per cent of the benign tumors (2). On the other hand in the one instance in which a patient with cancer came to the doctor because of pain as the original and predominating symptom, there was a slight dimpling of the skin giving the positive clinical picture of cancer and on examination of the specimen removed by complete operation, there was revealed a pronounced general connective-tissue hypertrophy which explained the tenderness.

2. *Multiplicity*—The finding of more than one lump practically rules out cancer inasmuch as cancer is very rarely multiple and when there is more than one malignancy in a breast or a cancer in each breast the positive evidence such as skin or nipple change is invariably present. Multiplicity on the other hand, is very common in hypertrophies and is noted in about 30 per cent of benign tumors.



Fig. 7 S P 22476 Adenomatous type of breast hypertrophy. Compare with Figure 6



Fig. 8 S P 1365 Typical lactation hypertrophy. Breast has been nursed 5 months. Note the 1. breast lobules at the bottom, which are not functioning. In other areas alveoli and ducts are greatly dilated with secretion.

(a) More than one lump therefore invariably means hypertrophy or benign tumor that is, solid areas of breast gland thickening or multiple cysts or multiple benign solid tumors.

3. *Position of the lump.* All lumps in the breast are either buried or superficial that is, they are located between the planes of the under and outer surfaces of the gland or they project, more or less, beyond these planes toward the chest wall or toward the skin. All cancers are buried, while perhaps 95 per cent of benign solid tumors are superficial. The hypertrophies may be either definitely buried or questionably superficial. In palpating therefore if the lump is distinctly buried it is either cancer or a cyst or a solid hypertrophy. If it is a cyst there may be fluctuation or there may be a flat or perhaps a very slightly dome shaped smooth spot on one side never found in cancer but very frequently seen in cysts or perhaps there may be a mass too great for a cancer without skin or nipple changes. If the mass is superficial it is either a benign tumor or an hypertrophy of the solid type. If the lump is a benign tumor it will be definitely spherical with a relatively narrow base of attachment or its spherical nature will be unquestionably evident by the palpation of a firm dome-like projection. On the

other hand a superficial hypertrophic mass is very frequently finger like that is it projects from the surface with a broad base of attachment and is thickest at the base.



Fig. 9 S P 359 Early involution following short period of lactation. Child 5 months old nursed 4 months. Note great dilatation with backing up of the alveoli and degenerative swelling of the lining cells. Operation for local excision of benign tumor.

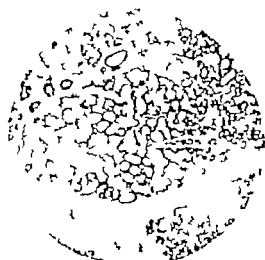


Fig. S P 318 Early involution. Child 3 months old not allowed to nurse. Three other children each nursed months. Breast removed for carcinoma.



Fig. S P 574 Ectatic type breast hypertrophy involving lactation hypertrophy or involution. Note dilatation of ducts and alveoli and degenerative swelling of lining cells, sometimes distinguishable macroscopically from true involution by the absence of intralobular connective tissue and by the presence of fat (upper right corner). Single burned mass—tender.

Hypertrophy frequently involves the whole lobulus from nipple to periphery giving a radiating indian-club-shaped mass and when more than one lobulus is affected a quadrant or the whole breast may be thickened. Such enlargements are never confusing but rather

It is the localized mass, involving less than a lobulus that may require close study. Thus a localized mass in the middle of a lobulus or at the nipple end usually is either a large cyst or a cancer and very seldom is solid hypertrophy. (Rarely is one still in doubt at this stage of differentiation in the presence of a benign solid tumor involving the ducts of the nipple region.) A mass in the distal third of a lobulus however may be either cancer, cyst, or solid hypertrophy and then one must rely entirely upon the shape of the mass for the differentiation.

4. *Shape of the lump.* An hypertrophy almost without exception follows the form of the breast gland in that there can be made out the irregularities as regards projections and crevices of the lobule or lobulus. Not infrequently the enlargement is proportionate in all directions and the result is, therefore, a flattened and often a pancake-like mass. In such cases the thickness is equal through out the whole width of the mass, or the variations in thickness can be demonstrated to be due to superficial projection. On the other hand a burned mass, harboring a cancer or a

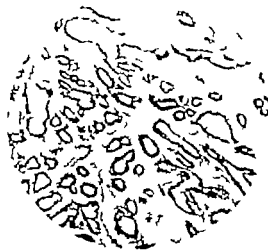


Fig. S P 560 Ectatic type of breast hypertrophy showing lactation hypertrophy or is obtained. Compare with Figure. Single biopsy—tender. Virgin age 4. Large cysts elsewhere in the breast.

cyt in its midst invariably is thicker at the middle point giving the impression of a sphere or some sort of a mass surrounded by an envelop of breast tissue

In the absence of pain or tenderness and multiplicity approximately 25 per cent of the bared tumors must be explored in order to determine the cystic (cyt) or solid (cancer) nature or to prove that the cyst is not associated with cancer

#### SUMMARY

1 Breast hypertrophy is a clinical entity with a variety of histological pictures

2 It is evidenced by an enlargement in the form of a lump involving a part of a lobule a whole lobule, two or more lobules a quadrant a hemisphere or the whole breast Not infrequently there are multiple lumps In both breasts each involving a small portion of a lobule

3 The histological picture simulates that of the normal breast in the various stages of

puberty hypertrophy pre-lactation, or lactation hypertrophy post lactation involution, or atrophy

4 Breast hypertrophy is not a new-growth and not a precancerous process inasmuch as the same histological pictures minus the gross hypertrophy may be seen in breasts that are normal

5 It can be recognized by the clinical picture and without the aid of the exploratory incision

6 It is not a local disease but a symptom of a disturbance which is located elsewhere in the body

7 The treatment is medical not surgical and is directed toward the cause rather than the local manifestation

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# DEPARTMENT OF TECHNIQUE

## LOCAL ANESTHESIA IN OPERATIONS ON THE NECK

### A NEW METHOD OF CERVICAL PLEXUS BLOCK

By WILLIAM R. MILLER, M.D. ROCHESTER, MIN. 1904  
*Section on Anesthesia, Mayo Clinic.*

HERMAN W. HUNDLING, M.D. ROCHESTER, MIN. 1907  
*Fellow in Surgery, The Mayo Foundation.*

IF local anesthesia is to be employed in a given operation, the operation field may be rendered anesthetic by terminal infiltration field block, or nerve block. The best method depends on the location and anatomical relationships of the region involved, and the character and extent of the operative work. If the area to be anesthetized is small, it is simpler as a rule, to infiltrate than to block. When infiltration methods are employed, it is often necessary to continue the injections during the operation, unless the field of operation is small and superficial. In such cases the injected solution causes distortion of the operative site and much of the anesthetic medium escapes when the retracted tissues are incised or it is sponged up during the course of the operation. Infiltration methods should not be employed in septic fields, malignant tissues, and areas of greatly lowered vitality because of the possible spread of infection or dissemination of malignant cells, and because of the occasional interference with healing.

If local anesthesia is to be induced as a preliminary procedure entirely distinct from the operation, regional methods, nerve block and field block are best employed. Also if the extent of the operation is not clearly defined, block methods are more appropriate. In such cases the anesthesia may be induced in a separate room by one especially skilled in this branch of work, and successful operations can be performed without loss of the operator's time. Successful blocking requires not only an accurate knowledge of the topographic anatomy but also of the physiology of the nerve trunks of the region. Certain areas are easily blocked, owing to the accessibility of the nerve trunks supplying them. In others, for the opposite reason, must be anesthetized by terminal infiltration.

The practical value of local anesthesia is, therefore, not the same in all parts of the body. It is especially suitable for operations on the neck. The small operative field, the absence of cavities, the presence of definite tissue planes, and the constant relationship of the nerve trunks to palpable bony landmarks, all make this region adaptable to both terminal infiltration and nerve block methods of anesthesia. In cases of superficial or well circumscribed lesions, the simpler infiltration method is more applicable. A similar superficial anesthesia is also produced by infiltration of the terminal branches of the cervical nerves by subfascial injections at the posterior border of the sternocleidomastoid muscles, but in order to obtain a deeper anesthesia the nerves must be reached at their emergence from the spinal column on a level with the transverse processes of the second, third and fourth cervical vertebrae.

#### NERVES OF THE NECK

The sensory innervation of the neck from chin to manubrium and from mastoid process to acromion, is supplied by the branches of the cervical plexus, which is formed by the anterior primary divisions of the four upper cervical nerves. After traversing the intervertebral foramina, they pass behind the intervertebral artery then lie in the sulci of the transverse processes provided for this purpose. The first then emerges between the rectus capitis lateralis and the rectus capitis anterior minor muscles, and the others between the intertransversarii muscles, and then between the rectus capitis anterior major and scalenes medius muscles. The second, third, and fourth nerves each divide into an ascending and a descending branch (the first does not divide). These branches are then connected in a series of loops constituting the cervical plexus, which lies

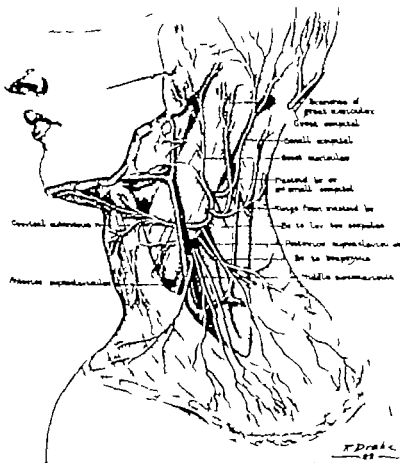


Fig. 1. Distribution of the superficial branches of the left cervical plexus. (Modified from Spalteholz.)

opposite the first four cervical vertebrae and on the scalenus and levator anguli scapulae muscles, and is covered by the sternocleidomastoid muscle. From this series of loops, superficial and deep cervical branches are given off (Fig. 1). The superficial branches are purely sensory, consisting of the occipitalis minor, the auricularis magnus, the cutaneous colli, and the supraclaviculars. The posterior primary divisions supply the posterior structures of the neck and head and give off cutaneous branches which run obliquely downward and outward overlapping the upper region of the back supplied by the thoracic nerves (Fig. 2).

The deep branches are divided into external and internal groups. Both arise beneath the sternocleidomastoid, the former passing away from the

median line of the neck, and the latter toward it. These branches are largely muscular and communicate to the deep structures of the lateral and anterior regions of the neck. They form the phrenic nerve also, and contribute to form the ansa hypoglossi.

#### CERVICAL PLEXUS BLOCK

The superficial branches of the plexus may be blocked by subfascial fanwise injections along the posterior margin of the sternocleidomastoid muscle at about its middle point. The deep as well as the superficial branches, may be anesthetized however by paravertebral injections. In the latter procedure the anesthetic solution must be injected in immediate proximity to the transverse processes of the cervical vertebrae (5). The

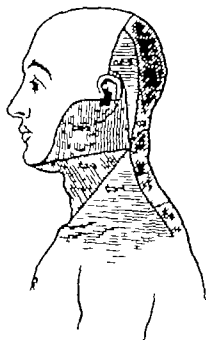


Fig. 2. Cutaneous anesthesia resulting from paravertebral injections of the cervical plexus. (Modified from Cunningham.)

plexus may be approached by either posterior or lateral routes.

**Block by the posterior route.** Block of the cervical plexus by the posterior route was first proposed by Kappas, and the method was further elaborated and more thoroughly described by Davis. With the patient lying in the ventral decubitus position as for laminectomy the chest is raised by cushions so that the head bends toward the sternum, thus making bony landmarks more easily palpable. The spinous processes are then defined and dermal wheals raised opposite the second, third, and fourth processes about 2 centimeters from the middle line (Fig. 3). These points may be carried lower if necessary as in laminectomy. A needle is advanced through each wheal in a direction parallel to the median longitudinal plane of the body until its point impinges on the lateral masses of the vertebrae. It is withdrawn and reinserted a little more obliquely outward, and as the previous depth is reached it may often be felt to glide past the lateral masses, after which it is advanced from 1 to 1.5 centimeters deeper. At this point an injection of from 5 to 8 centimeters of a 1 per cent procaine-adrenalin solution is made, while the needle is moved slightly to and fro (Fig. 4).

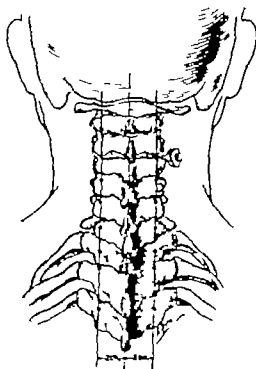


Fig. 3. Cervical plexus block, posterior route. (Modified from Panchet.)

The principal drawback of this route is its anatomical inaccuracy. The procedure is consequently a failure in many operations, especially those on the anterior aspect of the neck, and is therefore rarely employed. Advantages claimed for it are that there is no danger that the needle will penetrate an intertransverse space and thus wound the vertebral artery or puncture the dura. By advancing the needle too far, however, the jugular vein or carotid artery may be injured. The depth to which the needle must be advanced after bony contact with the lateral masses varies in different cases so that a considerable portion of the solution is distributed too far from the nerve trunks and none is deposited as close to the tips of the transverse processes as by the lateral method; thus anesthesia produced by the latter procedure is more efficient. The lateral route is used in operations on the lateral and anterior portions of the neck, the posterior method being employed only in cervical laminectomy.

**The lateral direct route.** This method of blocking the cervical plexus (Hendelhaun-Braun) has been rather extensively employed by most surgeons who use local anesthesia in operating. The

needle is advanced from the side directly on the transverse processes in a plane parallel to the cervical column. The superficial landmarks are much more reliable than those of the back of the neck. With the patient lying on his back and head tilted somewhat away from the operator, the tip of the mastoid process and carotid tubercle are palpated. The mastoid-carotid line connecting these two points, lies over the cervical transverse processes (Fig. 5). The carotid tubercle may not be palpable, in which case the row of transverse processes may be recognized by rolling the tissues around and at the same time exerting gentle pressure. A dermal wheel is raised at point *a* (Fig. 6) a finger's breadth below the mastoid process which is ordinarily on a level with the angle of the jaw. Another wheel is located on the line connecting mastoid process and carotid tubercle, and on a level with the superior cornu of the thyroid cartilage. Through these two wheels needles are advanced until contact is taken with transverse processes, at which from 5 to 8 cubic centimeters of a 1 per cent solution is injected. The transverse processes of the third, fourth, and fifth cervical vertebrae are usually located through wheel *b*, and of the second through wheel *a*. Besides blocking of both sides, solution is distributed subfascially and subcutaneously in the same plane. The quantity of solution need never exceed 30 cubic centimeters for the deep injections and 15 cubic centimeters for the superficial infiltration on each side or a total of 70 cubic centimeters of a 1 per cent solution. A single puncture is sometimes made at the posterior margin of the sternomastoid muscle near its middle point and 1.5 centimeters behind the external jugular vein. Fanwise injections are made from this point as deep as the transverse processes.

Block of the cervical plexus by the lateral direct route has been rather extensively employed during recent years in most surgical conditions of the neck, and this vast clinical experience has shown that the method is not without an element of danger (8, 35, 9). The needle must not be advanced between transverse processes because of possible injury to the vertebral vessels or intravascular injections. Spinal puncture, with consequent injury of the cord and intraspinal injection of the solution at this level, would also cause sudden and alarming symptoms.

The cervical transverse processes are rather thin and afford a poor surface of contact for the needle point. Intertransverse spaces are much wider. Since the transverse processes curve some-

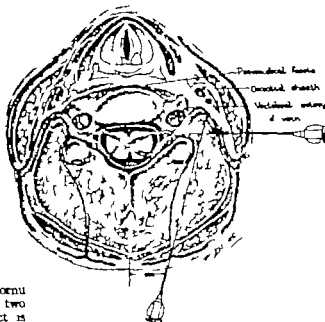


Fig. 4. Cross section through the neck at the level of the fourth cervical vertebra showing position of the needles in the posterior and lateral direct methods. Schematic distribution of the fourth cervical crv. is shown and fascial planes of the neck are represented diagrammatically.

what downward intraspinal puncture is more likely to occur when needle is advanced upward (Fig. 9). Even for stout patients a 3.5 centimeter needle is of sufficient length for paravertebral anesthesia of cervical region if the needle is advanced directly onto the transverse processes.

In early attempts at cervical plexus block the method was limited to one side only for fear of possible ill effects from bilateral block of the vagus or phrenic nerves. Wide clinical experience with bilateral plexus block, however, does not indicate functional disturbances attributable to block of these nerves. It seems probable that the prevertebral fascia, and that of the carotid sheath (Fig. 4) may serve as barriers to the diffusion of anesthetic solution to the vagus nerves sufficient to prevent block. When the injections are made close to the transverse processes, however, it is reasonable to believe that there is usually physiological block of both phrenic nerves since they arise principally from the third, fourth and sometimes fifth cervical segments and are not protected by fascial planes. In a study to determine the mechanism of occasional untoward results with cervical paravertebral injections, Wiemann blocked the plexus on one side, then observed the movements of the diaphragm with



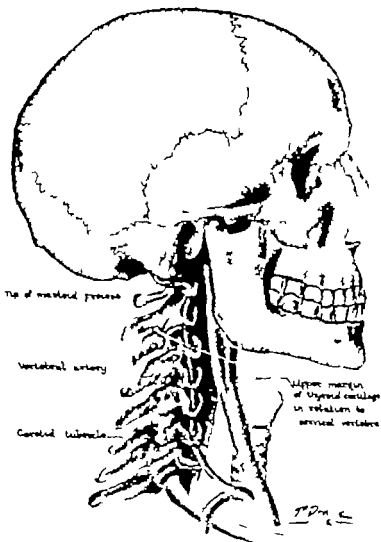


Fig. 5. Lateral view of cervical vertebrae showing the relation of transverse processes (the tip of the mastoid process, and the cervical tubercle) (Modified from Campbell.)

the fluoroscope. He found limited motion on the blocked side but without any subjective disturbances. Even with partial to complete temporary isolation of the phrenic nerves, the lower intercostals to the diaphragm prevent complete paralysis, and the accessory muscles of respiration compensate for any functional deficiency of the diaphragm.

Epileptiform seizures and collapse may be untoward results, and two cases of sudden death

have been reported which may have been caused by para-vertebral anesthesia. Holm reports a case of sudden convulsive seizures and collapse while blocking the cervical plexus. The patient revived gradually within 4 hours, and 3 days later the rosetectomy was performed under ether anesthesia without incident. Meyer reports two similar cases, which both of the patients recovered, and Herring mentions two cases in which alarming symptoms developed, neither of which were fatal.

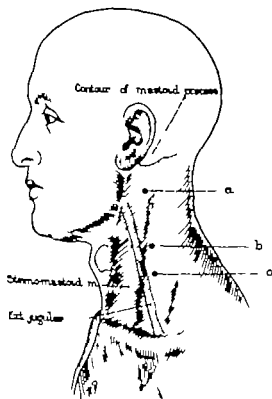


Fig. 6. Cervical plexus block by the lateral direct route and *b* are points of injection. *a* marks the carotid tubercle.



Fig. 7. Position of patient and operator in cervical plexus block by the lateral oblique method.

the two fatalities may have been due to accidental intraspinal injection, since the character of symptoms, their onset and course are essentially the same as the untoward results sometimes seen in spinal anesthesia.

**Lateral oblique route.** In order to prevent injury to the vertebral vessels, as well as puncture of the dura, we have performed cervical paravertebral nerve block by the lateral oblique method (25). In this technique the transverse processes are also approached through the lateral plane but from above obliquely downward (Fig. 7). With the patient in the thyroideotomy position and with the head rotated somewhat away from the operator the same landmarks are identified as in the lateral direct method. A dermal wheal is placed just below and almost contiguous to the tip of the mastoid process. Infiltration is carried toward the carotid tubercle for a distance of 4 or 5 centimeters, or wheals *b* and *c* (Fig. 8) raised at distances of 1.5 centimeters apart in the mastoid-carotid line. The needle is inserted at the highest wheal and advanced obliquely downward at an angle of 45 degrees with the median plane of the body while the line of transverse processes is palpated with the left hand. When bony contact is sensed from 5 to 8 cubic centimeters of novocain-adrenalin solution is injected the needle being slowly withdrawn as the injection is concluded. Similar injections are then made at the tips of the third and fourth cervical

Broett describes a fatal case death occurring during the performance of thyroideotomy. The injection of 140 cubic centimeters of a 0.5 per cent novocain-adrenalin solution was concluded without incident. Soon severe symptoms of collapse appeared and progressed to cessation of heart action and respiration. Artificial respiration and heart massage were of no avail. A similar fatal case is reported by Wiemann in which 14 cubic centimeters of a 1 per cent and 20 cubic centimeters of a 0.5 per cent novocain-adrenalin solution were employed in bilateral cervical plexus block. At necropsy status thymicolympathicus was discovered, and hematoma from injection on both sides of the neck which were thought to have interfered with vagus function. Winterstein reports a case of bilateral cervical plexus block for thyroideotomy in which rapid symptoms of collapse occurred. Complete paralysis of the left arm and slight facial paralysis persisted for 6 months. He ascribes these ill effects to puncture of the dura through an intervertebral foramen and direct injury of the cord. It even appears possible that all these cases of collapse as well as

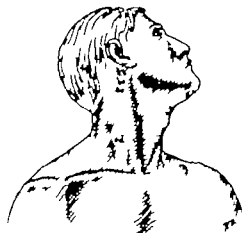


Fig. 8 Cervical plexus block by the lateral oblique method: mastoid-whale line *b* and *c* being located on the mastoid-carotid line to 5 centimeters apart, *d* represents the carotid tubercle.

transverse processes from wheals *b* and *c* respectively. Subfascial fanwise injections are made in the same plane in such a manner that, at completion, a wall of anesthetic fluid extending from skin to transverse processes has been projected.

Of the two lateral methods, the oblique is to be preferred to the direct because of its greater anatomical safety. There is no possibility of entering the intertransverse space with the oblique direction, as there is when the lateral direct method is used, and the needle never enters the intertransverse space far enough to reach the vertebral vessels (Fig. 9). Within the last years bilateral cervical plexus block by the lateral oblique method has been employed 272 times and unilateral block 34 times. Bilateral block has been employed in thyroidectomy resection of cervical and submaxillary lymph glands, and excision of branchial cysts. It has also been useful in laryngectomy and thyrotomy together with block of the superior and inferior laryngeal nerves and deep infiltration of the submaxillary region. Unilateral block has been efficient in cases of esophageal diverticula, as part of the procedure for osteoplastic flaps in brain surgery and gasserian ganglion operations. There have been no convulsive seizures or collapse and no clinical manifestations of functional disturbances of the vagus or phrenic nerves.

#### LOCAL ANESTHESIA IN SURGERY OF THE THYROID GLAND

One of the most convincing proofs of the value of local anesthesia in surgery of the neck is its

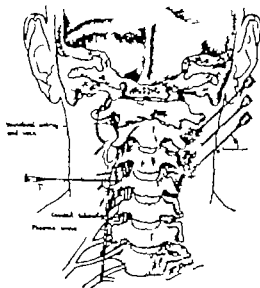


Fig. 9 Lateral routes of cervical plexus block. By the direct method, on the patient right, the danger of entering interspaces and injuring the vertebral vessels or cord is shown. By the oblique method, patient's left, there is no danger of such an accident (stippled areas on the left represent injected fluid).

advance in the favor of surgeons for the removal of goiter. Many surgeons attempt the use of local anesthesia in all cases of thyroidectomy even those of retrosternal extension. Within the last 5 years local anesthesia in thyroidectomy at the Mayo Clinic has increased from 27 per cent to 50 per cent in cases of simple goiter (Fig. 10). The use of combined anesthesia has shown a similar increase in popularity. In 9.8, 23 per cent of thyroidectomies for simple goiter were performed under combined anesthesia, while in 1923 the number had increased to 37 per cent. All anesthetics were regarded as combined, in which local injections were supplemented by inhalation narcosis, either nitrous oxide-oxygen or ether. The inhalation narcosis was usually of short duration, the patient usually being conscious during closure of the wound. Inhalation narcosis was necessary more often when terminal infiltration alone was employed. If intolerable pain was experienced it was usually during delivery of the gland. Often inhalation anesthetics were necessary for psychic reasons, in the absence of proper preliminary hypodermic narcosis. The absence of adrenalin in the anesthetic solution was also occasionally responsible for ineffective local anesthesia.

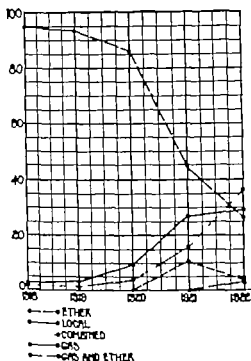


Fig. 10. Chart, showing anesthetics employed in all thyroidectomies for simple goiter during the past 5 years.

Figure 11 shows the increasing usefulness of local anesthesia also in thyroidectomy for toxic goiter. In 1918, local anesthesia alone was employed in 1.4 per cent of cases, and combined with inhalation narcosis in 0.6 per cent. In 1922 these percentages had increased to 30 and 48 respectively. The employment of ether alone has decreased from 98 per cent in 1918 to 3 per cent in 1922. It should be noted, however, that nitrous oxide oxygen and ether were combined in 22 per cent of the toxic cases in 1922.

The benefit to the patient of local anesthesia in surgery of the thyroid is indicated by the excellent results recently reported by Pemberton, C. H. Mayo, and Boothby for 1922. Aside from the general advantages attributed to the use of local anesthesia, there are special advantages in thyroidectomy. If the patient is erythematous either from intoxication or degeneration in essential organs, local anesthetics properly handled exert a more benign systemic effect than general. The heart is often badly involved in such cases and the strain on the kidneys is decidedly less with local anesthesia. The risk of injury to the recurrent laryngeal nerve by inclusion within the grasp of forceps or ligatures is not so great. When such accidents occur they may be detected

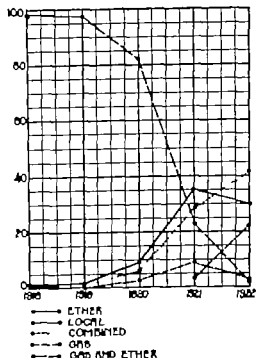


Fig. 11. Chart showing anesthetics employed in all thyroidectomies for toxic goiter during the past five years.

easily and corrected by the resulting disturbance in phonation. No temporary disturbance of the voice from anesthetics has been observed as when injections are made between the trachea and goiter. Hertzer asserts that having the patient cough forcibly as advocated by German surgeons, in order to force the gland upward is very effective, while Farr maintains that intra-thoracic goiters may be delivered by the patient in this manner.

Terminal infiltration is the method of local anesthesia most commonly employed in thyroidectomy. Starting at one or two points in the middle line of the neck and from the most prominent point of the thyroid tumor the line of incision is infiltrated along a curved line below the platysma on both sides as far as the sternocleidomastoid muscles, or even farther. The 0.5 per cent novocain-adrenalin solution is injected copiously from the proposed line of incision upward and downward into the subcutaneous tissues and often into the infrahyoid muscles, creating an anesthetized zone generously covering the thyroid tumor on both sides. This infiltration enables the skin and platysma to be incised painlessly and reflected upward and downward, and often the infrahyoid muscles may be clamped



Fig. 4. Anesthetic technique in thyroidectomy by the lateral oblique method. From a subcutaneous fanwise injections are made. This procedure is repeated on the opposite side.

incised and reflected without further injections. If there is distress the muscles are infiltrated copiously before dissection. A wide exposure is necessary so that traction from freeing the tumor and lifting it out of the wound will be reduced to a minimum. Deep injections from the lower and upper poles of the tumor toward the trachea and larynx will usually control the pain from the traction necessary in delivering the gland.

Most authorities of wide experience in local anesthetic problems recommend cervical plexus block at the posterior margins of the sternocleidomastoid muscles, the anatomical reasons for which are very apparent. Braun, Haertel, Farr, Pauchet, Labat, Allen, Hertzler, Hirschel, Smith, Danis, and others, all recommend block of the cervical plexus by the lateral direct route in thyroidectomy because of the deeper anesthesia afforded. When the anesthesia is to be induced as a separate procedure before operation, and especially when the infrahyoid muscles are not divided, block of the cervical plexus should be employed more often. In such cases bilateral block of the cervical plexus by the lateral oblique method combined with infiltration at the line of incision, has

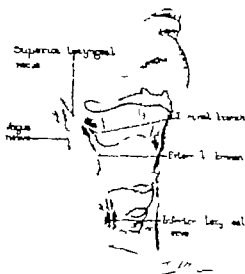


Fig. 5. Block of the superior and inferior laryngeal nerves. Shaded areas represent injected solution.

been found safe and effective (Fig. 12). The plexus block gives better relaxation of the muscles of the neck and greater facility in the use of retractors. In such cases from 25 to 30 cubic centimeters of a 0.5 per cent solution for each plexus, and from 30 to 50 cubic centimeters for subcutaneous infiltration, are employed. In non-toxic cases 10 minims of adrenalin 1:1000 are added to each 100 cubic centimeters of solution. When a 1 per cent novocain solution is employed in the plexus block, subcutaneous infiltration is not necessary, although a longer period of waiting is required for the development of cutaneous anesthesia. Usually in toxic cases no adrenalin is employed; better anesthesia results by the use of 1 per cent novocain.

Ligation of the thyroid vessels is ordinarily performed by local infiltration at the line of incision. This procedure is easily and quickly accomplished by distributing the solution subcutaneously and subfascially so as to expose painlessly the upper pole of the gland. If the deep manipulations are still painful, more anesthetic fluid is injected on both sides of the pedicle before ligation. One half per cent novocain solution is effective and may be used liberally without the addition of adrenalin.

#### LARYNX AND TRACHEA

Laryngectomy can be performed under local anesthesia with greater ease than under general

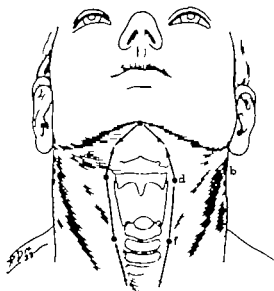


Fig. 14. Anesthetic technique for laryngectomy. *b* and *d* Represent cervical plexus block by the lateral oblique method. At point *f* the superior laryngeal nerves are blocked. From *d* and *f* the floor of the mouth is infiltrated by buccal injections in the same plane.

anesthesia (13-28). With local anesthesia there is not the annoyance connected with the anesthetic apparatus, tracheotomy tube and so forth and the operation can proceed in a free field. The operative mortality, especially from shock and bronchopneumonia, may be considerably reduced. New in 1917 reported a series of 15 cases of cartilaginous tumors of the larynx in which external operations, varying from complete laryngectomy to thyrotomy and removal of the tumor were performed. 5 patients died shortly after operation from pulmonary complications. Of a total of 9 thyrotomies performed during the last 2½ years at the Mayo Clinic 6 were performed under local anesthesia. During the same period four two-stage laryngectomies were performed entirely by this method. There was no postoperative mortality in the ten cases.

The nerves involved in laryngectomy are those of the cervical plexus described and the superior and inferior laryngeal. The superior laryngeal nerve, mostly sensory, divides a little below the great cornu of the hyoid bone, and somewhat in front of that divides into external and internal branches (Fig. 3). The internal branch distributes to the mucosa of the larynx, the base of the tongue and the pharynx. The recurrent laryngeal nerve is chiefly motor to the intrinsic laryngeal musculature.



Fig. 5. Anesthetic technique for oropharyngeal diverticulum. *b* and *d* Represent left cervical plexus block. In addition the operative field is covered with all of anesthetic solution.

In blocking for laryngectomy the patient is placed in the same position as for thyroidectomy. Bilateral block of the cervical plexus is performed by the lateral oblique method (Fig. 14). Pressure with the index finger on the great cornu of the hyoid bone on the opposite side makes it more prominent on the side to be injected. A wheal *d* is then placed 1 centimeter below and 1 centimeter in front of the greater cornu. The needle is then inserted medially and posteriorly and may be felt passing between the thyrohyoid muscle and the thyrohyoid membrane. At this point an injection of from 3 to 4 cubic centimeters of 1 per cent novocain solution is made. Twice the amount of a 0.5 per cent solution may be used the needle being moved somewhat to and fro or reinserted anew and the injection completed. From *d* and *f* the floor of the mouth is infiltrated by fanwise injections in the same plane. The infiltration is continued through point *f*. In most cases anesthesia results in from 5 to 15 minutes and if the technique has been properly followed the anesthesia will be sufficient for operations involving the vocal cords.

When the hyoid bone is to be divided the injections are carried well up into the floor of the mouth and the submental region. Block of the recurrent laryngeal nerves is usually unnecessary and when these nerves are injected it is best done during the course of the operation, unless there has been preliminary tracheotomy. Block of these nerves also produces paralysis of the intrinsic muscles of the larynx, which results in

dyspnoea. Certain authorities take the added precaution of inducing surface anesthesia by direct applications to the laryngeal and pharyngeal mucosa. The thyrohyoid membrane may be perforated and 2 cubic centimeters of a 0 per cent cocaine solution instilled, drop by drop. The mucosa of the trachea may be anesthetized by swabbing the mucous membrane with 10 per cent cocaine on an applicator. The tracheal mucosa may also be anesthetized before opening by injections into its lumen. As soon as the trachea is laid bare, puncture may be made between two tracheal rings and from 5 to 15 drops of a 2.5 per cent cocaine solution slowly injected (34).

Anesthesia is easily possible without block of the cervical plexus when it is necessary to inject around the whole larynx and upper trachea. Wheels are placed on either side of the larynx and trachea about 2 to 3 centimeters from the middle line, from which injections are made around the entire larynx. Deep injections are also carried well into the submaxillary region. If block of the superior laryngeal nerve is correctly carried out, the local application to the mucous membrane is hardly necessary.

Local infiltration is sufficient to produce anesthesia in tracheotomy. The line of incision is first infiltrated, then the subcutaneous tissues, and the tissues around the trachea are injected by directing the needle laterally and posteriorly from the same line. By displacing the skin further laterally it is possible to infiltrate the space between trachea and esophagus. In emergency cases infiltration along the line of incision is adequate.

#### DIVERTICULA OF THE ESOPHAGUS

The special advantage of local anesthesia in operations for the removal of diverticula of the esophagus consists first in the lessened danger of bronchopneumonia from aspiration of the contents of the sac. C. H. Mayo reports a case of pneumonia resulting from the contents of the sac pouring into the trachea under general anesthesia. Bartlett suggests that the sac may be identified after dissection to the region of the diverticulum by having the patient distend the mouth and pharynx with air thus distending the sac. The technique of producing the anesthesia consists first in block of the left cervical plexus, usually carried down to the fifth and sixth cervical vertebra. Infiltration is then made to encase the operative field, as in Figure 5. If the sac is large and adherent, especially if it is intrathoracic, there may be intolerable pain in freeing and delivering it. The mucous membrane of the esopha-

gus is insensitive to pain, but moderately sensitive to heat and cold.

#### LYMPH GLANDS

Excision of small isolated and well defined groups of diseased lymph glands may be performed under circular infiltration. Care should be exercised not to make the injections into the substance of a gland which might cause its rupture with liberation of infection. For the more extensive operations as total extirpation of all lymphatic glands, and even of the submaxillary salivary gland following operations for carcinoma of the lower lip, block of the cervical plexus is the best technique.

After block of the plexus on both sides by the lateral oblique method, the operative field is circumscribed by subcutaneous injections along the posterior margin of the sternocleidomastoid muscle above the clavicle and sternum, and into the floor of the mouth along the border of the lower jaw. If the submaxillary gland is to be removed also, injections are made well into the submaxillary space close to the medial border of the mandible. From 100 to 150 cubic centimeters of a 0.5 per cent solution will be required. Difficulty may be encountered in dealing with glands which are matted together or broken extensively. These may be located laterally in such a position as to make plexus block by the lateral method a difficult procedure. In such cases the posterior method of approach may be employed to advantage.

#### MISCELLANEOUS

Other operations which may be performed to advantage under local anesthesia are ligation of the carotid arteries, excision of a branchial or thyroglossal duct cyst or division of the sternocleidomastoid muscle in torticollis. For these procedures the cervical plexus may be blocked on one or both sides as needed. For the incision, excision or cauterization of furuncles and carbuncles of the neck, local anesthetics are ill suited. The infected and inflamed tissues often extend over the entire lateral or posterior aspects of the neck. The neck is extremely sensitive and the infective process painful. Often it is difficult to foretell the extent of suppuration. The region is swollen, and the neighboring tissues adherent, so that it hardly seems justified to penetrate such tissues with needles. In most cases, therefore, a short general anesthetic for the cavity excision of furuncles and carbuncles is far more comfortable for the patient and more effective for the surgeon.

## DISCUSSION

The efficacy of local anesthesia in surgery of the neck has been repeatedly demonstrated and yet considerable difference of opinion exists among surgeons with regard to the proportion of such operations in which local anesthesia is indicated. Many still regard local anesthetic procedures with distrust which can in most cases be attributed to unfamiliarity with the technique in all its phases. Probably indifference to the essentials rather than ignorance of the essentials of proper technique in producing local anesthesia and methods of handling the patients, has done more to retard progress in the use of local anesthetics than all other factors. Certain obvious refinements in technique should always be observed, as, for example, raising an intradermal wheal with the finest hypodermic needle at a point where a coarser needle is to be introduced. Much less pain is produced by passing the longer needle through the tissues slowly and by injecting the solution progressively as the needle advances.

As in all other surgical procedures, satisfactory work cannot be performed with unsuitable instruments. Many who have given local anesthesia methods a trial, have used ordinary hypodermic syringes and needles, and uncertain solutions. Injections have been made haphazardly and the methods abandoned as unsatisfactory. An assortment of various sized, bright, sharp flexible steel needles of fine bore and a smooth-running syringe are necessary requisites for the painless execution of any local anesthesia procedure. The many self-filling syringes, pneumatic injectors, and so forth, on the market today have only served to make the technique more difficult. These machines are in general, cumbersome, hard to sterilize, and get out of order very quickly. They represent a complex, clumsy apparatus for the performance of a simple task.

## PREPARATION

Equally as important as skill in the induction of local anesthesia is the proper preliminary preparation of the patient. Undoubtedly the mental attitude of the patient has almost as much to do with the success of the operation as the anesthesia itself. The co-operation of every person connected with the patient is necessary in order that he may go to the operating room in a confident and tranquil mood. Often a patient will anticipate trouble because a clerk or orderly has given advice as to the form of anesthetic, ignorant of the harm being done. If as the result of co-operation, an attitude of confidence has been created the operation may be completed even

if the patient is neurotic while he thinks he is undergoing the preliminary preparation of the operative field.

The terrors associated with the operating room and the unpleasant impressions made on the patient by everything connected with an operation may be abolished or considerably diminished by the preliminary hypodermic administration of a narcotic drug. The amount given must be determined for the individual case and will vary according to the age, weight, temperament, and general resistance of the patient. Pantopon possesses advantages over morphine in that it is not as depressing to circulation or respiration, it is not often followed by nausea and vomiting, and it is equally as effective in the control of pain. Scopolamine hydrobromide in small amounts tends to produce an indifferent or sleepy mood. The administration of these two drugs together in proper amounts one-half hour before anesthesia is induced and repeated if necessary during anesthesia at least 15 minutes before operation, is the best preliminary preparation. The patient's mind is sufficiently blunted to outside influences so that the operation will not cause further excitement although the stage of twilight-sleep need not be reached. It is to be noted however that the general resistance of the patient is a factor in determining the advisability of preliminary narcotics, and that in poor surgical risks they are usually unnecessary. Narcotics may only serve to increase the operative risk if the patient's general condition renders him indifferent to his surroundings.

## CONCLUSIONS

1. The neck is one of the most favorable regions of the body for performing operations under local anesthesia. The anatomy of this region is such that either infiltration or regional methods (nerve block and field block) may be employed.

2. If anesthesia sufficient for the conclusion of the operation is to be induced as a pre-operative procedure regional methods are more frequently employed because of the deeper anesthesia.

3. Block of the cervical plexus by the posterior route is employed in cervical laminectomy as part of the procedure in craniotomy for cerebellar explorations, and occasionally when there are contra-indications to the employment of the lateral routes.

4. Of the two lateral routes the oblique is preferable because of the greater anatomical safety.

5. Block of the cervical plexus by the lateral oblique method is valuable either alone or combined with infiltration, in operations on the lateral and anterior regions of the neck.



6 Operations which may be satisfactorily performed under local anesthesia include thyroidectomy, laryngectomy, thyrotoxy and removal of tumors, excision of oesophageal diverticula, removal of lymphatic glands, excision of branchial cysts, tracheotomy, ligation of thyroid or carotid vessels and cervical limbectomy.

7 For the excision of furuncles and carbuncles, extensive degenerating glands of the neck, and widely disseminated carcinomatous gland, general anesthesia methods should be employed.

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RADIUM TREATMENT OF CARCINOMA OF THE ANTRUM<sup>1</sup>

BY FREDERICK M. JOHNSON M.B. New York

THE problem of treating malignant tumors of the maxillary antrum seems to have passed the stage of radical surgery. Numerous operations have been devised and performed. Depending on the boldness and skill of the surgeon conservative excision of the growth and radical resection of the upper jaw have been advocated. But an investigation of the results indicates that such efforts have failed to cure and in many instances have actually hastened a fatal termination. For example, Scudder (1) who is a very experienced operator states that even the most painstaking surgery rarely succeeds, and that it is the exception rather than the rule to find cured cases with authenticated laboratory report. Bloodgood (2) more recently was unable to find in his records of 30 years one solitary case of proven carcinoma of the antrum cured by excision of the upper jaw. Thus persuaded him to replace the cutting operation by the cautery by which method one patient has been made free of disease for 5 years. Martens (quoted by Scudder 1) has collected 49 cases from the literature of which only two were well for any length of time following operation. But the ultimate hopelessness of resection of the upper maxilla is not the complete story, because from the European clinics comes the tale of an operative mortality of 15 to 30 per cent. Koenig (quoted in Scudder 1) experience at the Gottingen clinic is even worse, for in 48 total upper jaw resections there were 19 operative deaths (39 per cent).

With the introduction of radium it was hoped that at last we had at our disposal an agent on which reliance could be placed if used in conjunction with conservative surgery. But it appears that the factors which caused surgery to fail hinder in the same manner the newer form of treatment. These conditions are:

1. Carcinoma of the antrum is locally a highly malignant disease. It grows rapidly, infiltrates deeply and invades bone and ly. but the lymph gland are rarely involved.

2. Accurate and early diagnosis is rendered difficult by the fact that cancer itself does not produce peculiar clinical signs and symptoms and it is only when a tumor produced the mechanical disturbances appear. But this appearance is slow and tedious when the growth is a hidden cavity like the antrum and the diagnosis of the disease is often too late for successful treatment.

3. As is the case with all cancers of the mouth and nasal passages, inflammatory processes may predominate, and an incomplete diagnosis of empyema of the antrum, or simple polyp may delay proper recognition of the essential disease until the neoplasm is hopelessly advanced.

Numerous contributions on experience with radium therapy have been made to the current medical literature during the last few years. While many of these are nothing more than single case records, a general review of them indicates that distinct advances are being made. New (3) reports from the Mayo Clinic that in carefully selected cases he opens the floor of the antrum with a hot soldering iron thereby destroying the growth by heat. Radium is used later as indicated. He claims that the results are much better than with jaw resection and mentions three cases clinically free of disease for 13 months, 15 months, and 17 months.

Our experience in the use of heat in antral cases has not been satisfactory enough to warrant its adoption as the method of choice. It is true that a bulky portion of the neoplasm is destroyed quickly. On the other hand microscopical evidence indicates that it surrounding it, there is produced a paralysis of blood vessel wall and a dilatation of lymphatic spaces. Moreover there is an inhibition of lymphocytic infiltration the presence of which is now thought to be of the greatest service in local cancer restraint. The cautery therefore produces an effect which is diametrically opposed to that of radium. Unless we are fortunate enough to kill every cell of the cancer during the heating process, we fear that the effect of the cautery on the outlying tissue would tend to spread the disease.

Ochsner (4) Blandell (5) Greene (6) and Patterson (7) have also contributed recent articles on the management of such cases by radium.

Carcinoma of the antrum is not an uncommon disease. Ewing states that at the Memorial Hospital during the years 1916-17 out of 1892 cases of cancer of all types admitted 35 (1.84 per cent) involved the maxillary sinus. He recognizes the following types:

Papillary carcinomata, some of which are malignant transformations of papillomata.

2. Carcinomata of basal-cell type. These are often designated as a keratin cystic epitheliomata, endotheliomata, or cylindromata.

3 Squamous-cell carcinoma which arises by metaplasia from previously altered lining epithelium

4 Cylindrical-cell carcinoma which forms a bulky tumor and is unusually malignant. It is adenocarcinomatous in type

5 Round-cell carcinoma of atypical structure which is often designated as sarcoma

6 Dental tumors which not infrequently develop in the antrum. They include the squamous and glandular types of adamantinoma

The exact point of origin of carcinoma of the antrum is usually never determined. Many undoubtedly arise from the mucous membrane of the sinus itself. Epithelial rests in connection with a tooth-socket may account for some. Phillips (9) has recorded in detail 16 cases which were described as burrowing epitheliomata. They grew from a tooth-socket and developed upward in the direction of least resistance, filled the antrum, and then burst through the alveolus after the extraction of the teeth for the relief of pain. Others spring from the mucous membrane of the ethmoid region and after occluding the nasal passage spread along the orbital plate. Certain it is that no matter where the seat of origin, the soft friable inflamed growth readily fills the cavity and as development continues erodes the bony walls which are confining it. Thus the orbital contents and the capsule of Tenon may become involved producing a prominent and faulty moving eye. Or pressure may be exerted on the thin facial wall in which event perforation occurs near the infra-orbital foramen producing a swelling of the cheek and later ulceration. The more extensive cancers advance through the posterior wall into the pterygoid fossa rendering the prognosis hopeless. In many cases the alveolus and palatine process are the last to be destroyed and a mushroom-like tumor sprouts through into the mouth, being thereby the means of finally forcing the sufferer to seek treatment.

As has been indicated, antral cancers may produce signs and symptoms referable to the nose, orbit, or teeth long before the presence of an associated tumor is suspected. Therefore rhinologists, ophthalmologists, and dentists have the first opportunity of making a diagnosis and instituting appropriate treatment. Too often our records reveal one or more intranasal operations on recurring polyps which of course are secondary to the malignant disease or a dental surgeon extracts molar teeth because of pain, with the result that the sockets do not properly heal, but become filled with a new tissue which for a time is believed to be proud flesh. Again an antral

empyema is suspected, and a very conservative opening is made in the anterior wall for irrigation purposes.

The first symptom in many cases of this series was persistent pain or burning over the cheek, due to irritation of the fifth nerve. Later this pain was referred to the teeth or forehead. There was usually temporary relief when the tumor perforated. Nasal obstruction was a common first symptom, and was accompanied by a purulent and later a blood stained discharge. The average duration of such symptoms before the patients were first seen at this clinic was 7 months. Tenderness over either the antrum on percussion, or the palate on pressure, was frequently present. Radiographic examination was of great value in revealing a definite antral opacity and if the tumor was large, there was a distortion of the turbinates and septum. If any doubt exists after such findings, an exploration from below is certainly advisable. This is strongly advocated by Moore (10).

In general the plan of treatment that has been developed at the Memorial Hospital includes the pre-operative, the operative, and the postoperative use of radium.

*Pre-operative treatment.* The antrum and accessory sinuses are subjected to a maximum pack treatment from a distance of 6 centimeters. The "pack" is a flat brass box with walls 2 millimeters thick, and an area of 77 square centimeters. It contains silver capsules of glass emanation tubes. The dosage given is about 9,000 millcurie hours, which will produce a slight skin erythema. The lymphatic glands of the neck are exposed in the same way. With such heavy filtration only the deeply penetrating rays are effective. When the available emanation was limited, we have recently substituted X-radiation in the pre-operative phase of treatment. Although theoretically not as efficient, it nevertheless has a distinct field of usefulness, especially in clinics that are equipped with only a small amount of radium.

*Operative treatment.* Before the tumor area is touched, a 1 centimeter skin incision is made under local anesthesia along the anterior border of the sternocleidomastoid muscle. The lymph-bearing tissue close to the internal jugular vein and in the posterior submandibular space is exposed and examined. If there is any suggestion of metastases, a complete neck dissection is at once performed. If not, unfiltered emanation tubes are inserted, and the external carotid, lingual, and facial arteries are ligated. By tying the latter two vessels the establishment of a vigorous anastomotic circulation is much delayed.

Although such a careful observer as Butlin (11) did not approve of a preliminary ligation we believe from experience that it is a wise procedure for two reasons. First, the danger of serious hemorrhage from the primary growth is much reduced both during the second stage of the operation and at a later date when the radium slough separates from the antrum and second, the starving effect on the tumor is a distinct aid to any method of radiation treatment. We have performed the operation of ligation in well over 400 cases of oral and associated cancers with no bad results. Matas (quoted by Scudder) refers to two fatalities from cerebral embolism, but there seems to be no danger if the point of ligation is well above the origin of the superior thyroid and the lingual and facial arteries are tied separately.

The antral operation is performed at the same time or postponed a few days, depending on the patient's condition. It is essentially an operation to expose the growth for radiation. The method of approach varies with the local condition.

1. Many cases present signs of increased intra-orbital pressure and a swollen cheek with the swelling most prominent adjacent to the inferior rim of the orbit. The palate and alveolus indicate no evidence of invasion. The cancer has, therefore, followed the orbital plate, and not the nasal floor. The logical operation is to make an opening closest to the bulk of the growth, namely through the floor of the orbit. At first we hesitated to sacrifice a functioning eye, but we now believe that in many instances our hesitancy was the cause of ultimate failure. In a few patients with the eye remaining *in situ* the severity of the radium inflammation in adjacent tumor tissue forced us to remove it subsequently. These patients would have been spared much suffering if we had been less conservative at the outset.

2. In another group there are no orbital signs and symptoms, and the external tumor is well below the eye. The alveolus and palate are however swollen and perhaps destroyed. The cancer has therefore grown downward, and is best reached through a large window made below.

3. A third and smaller group may require an opening through both the orbit and the alveolus. These are very advanced cases, but we feel that in selected patients there is the possibility of clinical cure or palliation.

Radium is applied by tying unfiltered emanation tubes in the end of an ordinary rubber finger cot, and packing it centrally or toward any wall depending on the needs of the case. As a rule about 35 to 40 millicuries are used for periods varying from 48 to 60 hours. This dosage, of

course, produces an intense caustic effect, but we believe that nothing less will suffice. In 6 to 10 weeks slough and destroyed bone are gradually cast off. As may be inferred we place our main reliance on the destructive qualities of radium and not on cauterization or curettage.

*Postoperative treatment.* During the weeks following the operation constant attention is given to the radiated area. Frequent irrigations are absolutely necessary on the part of the patient because when the radium slough commences to form a very disagreeable odor is given off. Loose stringy necrotic tissue and fragments of destroyed bone should be gently removed. If a large sequestrum forms, many weeks may elapse before it loosens and separates. While in place it is a constant source of annoyance, because of pain and suppurative discharge. Excessive granulation tissue may form about it, giving the false picture of a recurrence. After the effect of the operative treatment subsides, careful observation is made for possible neoplastic nodules that have not completely regressed. If any such areas are present, and they appear to be enlarging, emanation tubes or filtered needles are applied. But caution should be used in order not to treat unnecessarily because it is our experience that regression may continue even though outward radium effects have disappeared.

This series of cases from the Memorial Hospital records comprises 24 carcinomata of the antrum. Of these 12 were in females and 12 in males.

The age incidence is as follows:

Decade	Cases
Fourth	3
Fifth	10
Sixth	5
Seventh	4
Eighth	2

Before being referred to the hospital 11 cases were surgically treated for wrongly diagnosed empyema. Five sought the attention of a dentist who extracted teeth for the relief of pain. Two cases were operated on intranasally one or more times for obstruction. One patient had a complete resection of the upper jaw with a large recurrence.

Cervical nodes were present only three times. In one case on account of patient's poor general condition, emanation tubes were inserted and no attempt made to do a complete neck dissection. In all except four instances roentgenographic examination revealed the destruction of one or more of the walls of the antrum. It may therefore, be concluded that the cases taken as a group were far advanced.

The results of treatment are briefly as follows:  
Four cases were unimproved. These were hopelessly advanced. All were in poor general condition and died before the results of radiation could be determined.

Four cases are showing a satisfactory response to the operative treatment.

Eight cases were improved locally and generally although they were never at any time free of malignant growth. The duration of palliation extended in one instance to 4 years.

Four cases present no clinical evidence of disease for varying periods, as follows: 2 cases for 1 year, 1 case for 1½ years, 1 case for 5 years.

In addition 3 cases were free of disease for 1 year, 3 years, and 4 years, but later failed to return to the clinic so it must be assumed that they finally succumbed to cancer.

The last case of the group was free of disease for 6½ years, but after neglecting to come for observation for several months, returned with a large recurrence projecting from the roof of the antrum. This is being treated at the present time.

Two case records are given in detail.

CASE (3137) W. B. female age 38, came for treatment in November, 1908, giving history of neglected teeth. Following the extraction of some troublesome molar roots swelling of the gum appeared, which was followed in a few months by the protrusion of the eye on the same side. At first pain was severe and was treated in the clinic and forehead. Ten months before coming to the hospital an ulcer developed in the roof of the mouth, close to the site of the previous dental extraction. The pain was then temporarily relieved.

Examination revealed that the patient was pale and anemic. The left cheek was often red and the left eye was more prominent than the right. The nasal passage was completely occluded, and occupying the entire half of the hard palate was an irregular ulcer 3 by 4 centimeters in area. As not on the record says: This is a very advanced case in a woman of poor general condition. Treatment should be directed toward palliation and not a cure. Microscopic diagnosis was epidermoid carcinoma. She was treated by embedding unfiltered emanation tubes directly in the growth through the palate. Radium was used in November, 1908, February, 1909, and April, 1909, following this the local condition was satisfactory until March of 1911, when further radium application was made because of evidence of active tumor growth. The patient died in July, 1912, from chronic sepsis and circulatory failure. Necropsy was obtained. This case is of interest in showing that long palliation can be obtained by the use of radium without operative interference.

CASE (3737) M. S. male age 47 came to the hospital in September, 1906. His illness commenced 3 months earlier with the appearance of a small lump on the alveolar process of the right upper jaw. The right side of the face soon became swollen. A dentist as consulted, he removed teeth. The socket never healed. Examination on admission to hospital showed that the patient was in poor general condition. An egg-shaped ulcerated mass 3 by 5 centimeters projected from the alveolar and palate. Laterally there was a deep swelling of the cheek, the

skin of which was red. Nasal examination revealed that the ethmoid area was not involved. There were no palpable nodes in the neck. The late Dr. Jansway ligated the neck vessels, removed what was left of the floor of the antrum, and applied unfiltered radium emanation.

After a few weeks, large portions of alveolar and dead bone came away leaving a healthy cavity. There were no further manifestations of the disease until January, 1913, when recurrence was noted close to the floor of the orbit. This was treated by packing finger cut of emanation tubes close to the tumor mass. In a few weeks the cancer area sloughed away exposing the floor of the orbit. A small discharging fistula formed below the lower eyelid communicating with the anterior orbital wall, portion of which was destroyed. This caused considerable degree of orbital inflammation, and for while we believed that the eye was in danger. However, in June the absorption loosened, and was removed through small window made in the cheek surrounding the fistula. It proved to be the orbital plate with large portion of the anterior wall. At the present time there is no evidence of new growth. This illustrates that it is hardly wise to consider a case cured even after nearly 7 years. The patient is to be congratulated as long as no recurrence appears.

#### SUMMARY

1. Cancer of the antrum must be recognized in the early stage before any method of treatment will produce uniform and favorable results. The opportunity is given to rhinologists and dentists, but facts indicate the tardiness with which they make an accurate diagnosis.

2. Conservative surgery combined with radium promises to give better results than does the radical operation.

3. Palliation for a large number of hopelessly advanced cases is possible through the conservative use of radium.

4. The successful application of radium depends on an adequate exposure of the area. As a rule an oral approach is best, but if conditions demand it the eye should be removed and the floor of the orbit opened.

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## A NEW SPLINT FOR FRACTURE OF THE HUMERUS

B. CARL R. STEINKEL, M.D. F.A.C.S. ALBANY, OHIO

GENERALLY fractures of the humerus in the newborn are not hard to hold in position once good alignment is obtained. The muscle pull is slight and the bones are rather easily controlled.

The splint to be described is applicable for fractures of the humerus and clavicle in the newborn. The splint is permeable to the X-ray and seems to meet most of the requirements for the proper reduction and retention of the fragments.

The curved wire is covered with muslin or diasecloth to support the head. The inside measurement is  $6\frac{1}{4}$  inches across

length when it is closed up and 13 inches long when it is extended and is  $1\frac{1}{2}$  inches wide.

The body piece is also adjustable as to length being  $6\frac{1}{4}$  inches long through its center when closed up and  $8\frac{1}{4}$  inches when the extension piece is drawn out. The width of the body piece is  $3\frac{1}{4}$  inches at the narrowest point and  $4\frac{1}{2}$  inches at the widest.

The infant is bandaged to the body piece and the extension is applied to the arm. Coaptation splints are used at the point of fracture in the humerus. The fragments can be adjusted under the fluoroscope and when they are in good position the body and arm of the infant along with the splint are encased in plaster of Paris.

This allows for easy handling and caring for the baby who can be placed at the mother's breast

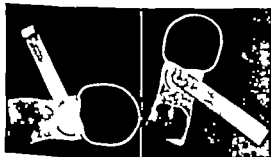


Fig. 2. Photograph showing front view of the splint for fracture of the humerus in the newborn.  
Fig. 3. Back view of the splint.

The lateral arm piece is adjustable as to length and angulation of the arm with the body. It may be adjusted for the right or left arm. The two perforations in the upright piece at the outer end of the extension are for the attachment of a windlass or a rubber banyo type of extension may be employed. The arm extension is 13 inches in



Fig. 3. How the infant appears on the splint. Bandage, head rest, 1, coaptation splints, 4, adjusting arm extension, 5, adhesive extension, 6, inflator.

without inconvenience. The infant's toilet is easily and safely cared for as there is little danger of displacing the fragments after the plaster is employed. The method is applicable in bad fractures of the clavicle.

I am greatly indebted to Dr. Joe L. McFerris for valuable suggestions during the development of the splint.

## MODIFICATION OF ESTLANDER'S OPERATION FOR LIP DEFECT

BY ELMER D. TWYMAN, M.D., F.A.C.S., KANSAS CITY, MISSOURI

Attending Surgical Staff, St. Luke Hospital, Burroughs, Christian Church Hospital, Surgical Courtesy Staff, St. Joseph Hospital, Surgical Courtesy Staff, Kansas Hospital

PROPER surgical removal (1) of an epithelioma of the lower lip may result in a defect requiring a plastic operation for the restoration of the defect. Lesions in or near the midline leave particularly large gaps in the mid space. All surgeons are familiar with the incisions credited to Grant (2), which run downward and outward in the line of or parallel to the facial artery. These incisions make it possible to sew the lower lip in the midline and afford a valuable and quite logical device because the incision follows the natural line of spread of the growth, uses the seldom involved chin as a prop to maintain proper form and lastly can be extended into the neck when it is desired to dissect the submaxillary and submental glands, and to mobilize widely the flaps to be moved. This repair is often all that is needed. However at times the result is a tight lower lip and a pouched upper the mouth tending to be too small. The same defect may appear in repairs of a lower lip from which an epithelioma has been removed by the classical but obsolete V-shaped incision.

Two operations have been described, each of which overcame one of these consequential defects. Burrows did away with the pouching upper lip by outlining and sacrificing a triangular piece at both corners of the upper lip. This did not take the tension off the lower lip nor enlarge the small mouth. A useful piece of tissue is un-

necessarily sacrificed. Estlander's operation (3) takes a triangle from the upper lip and puts it in the lower one. No unnecessary tissue is sacrificed and the tension on the lower lip is released, while the pouched upper lip is reduced to normal proportions. However the mouth as a whole is smaller than ever. I have attempted to overcome this difficulty.

Figure 1 shows the condition following a Grant operation or the typical V-shaped removal and repair. The mouth is smaller, the lower lip tight, the upper lip pouching.

Figures 2 and 3 show the outlining and disposal of a triangular flap, a modification of Estlander's operation which I regard as an improvement because it remedies all the defects mentioned including the smallness of the mouth. I did this under local anesthesia. A triangle is outlined and cut from the upper lip at each corner of the mouth, its apex upward in the nasolabial fold, its base downward and its lateral side prolonged downward and outward lower than the angle of the mouth. The nourishing pedicle left is attached to the lower lip inner side. Additional room is had by a further incision extending outward in the line of the mouth. As the tension of the lower lip is released the lower incision gap opens a space is opened up into which the triangle of tissue from the upper lip naturally fits. Suture of the sides of the defect in the upper lip makes a natural looking line, the nasolabial fold. The



Fig. Results after Grant operation



Fig. Lines of incision for modified Estlander operation



Fig. 3 Result after the author's modification of Estlander operation

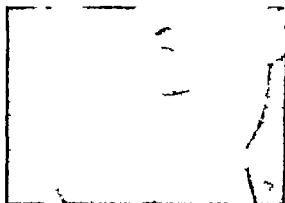


Fig. 4 Photograph showing final results of author's modification of Estlander operation

mucosa is suitably sutured at the corners. Leaving the sustaining pedicle attached to the lower lip instead of the upper allows indefinite lateral extension of the os without endangering the nutrition of the triangle to be moved. Accurate measurement demonstrated in advance the gain that would be made. Figure 4 (a photograph)

shows the final results which were satisfactory both for looks and function.

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## MODEL OF UNIVERSAL CASE FOR SURGICAL DRESSINGS

By Dr. GUILLERMO BOSCHI ARANA, BUENOS AIRES, ARGENTINA

IN the daily round of making dressings in hospital wards the surgeon requires a dressing case containing dissecting forceps, scissors, lancets, sounds, and curettes. For this purpose every surgical ward should have as many sets of forceps as there are beds, for I consider that 50 per cent of the patients in the ward need surgical dressings. Such an equipment would relieve the surgeon of the necessity of burning the instruments, a reprehensible and costly practice in the long run because of the rapid destruction of the nickel plating necessitating the constant and frequent renewal of the instruments used for dressings.

A short supply of forceps is poor economy for it is evident that a forceps burned is a forceps

ruined in a very short time whereas, if we have at our disposal as many forceps as there are patients, that is, one for each bed we may sterilize them by boiling and so make them last much longer. On the other hand, a dissecting forceps may be valued at a dollar and so the outfit for a ward of 50 beds would not exceed fifty dollars.

In the cases for ordinary surgical dressings we find the instruments—scissors, forceps, sounds, or curettes—all huddled together without due attention to asepsis. To get out a pair of forceps or scissors, we have to remove those on the top which cover up the one we need and we tip the whole contents of the case, shake the instruments roughly or even stir the mass with one of the instruments.

Any one of these maneuvers is objectionable in the light of antiseptic surgery. If by good fortune the instrument sought is on the top of the others in grasping it with the fingers, it would not be unusual, and it is usual, to touch another instrument near and thereby soil it and it soils those near it as a natural consequence so that after a fourth or fifth dressing, all the instruments would fall under the ban and suspicion of being septic.

If the instrument sought for is entangled or covered with the others, it is impossible to get it out with the fingers, and if we have recourse to a dissecting forceps, we must move the instruments about, get hold of one and not lose patience if it grips another or becomes entangled with another which loosens itself most casually and frequently drops to the floor while we are trying to disentangle it.

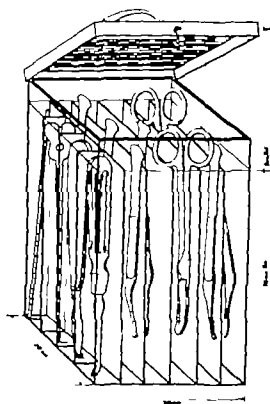


Fig. 1. Diagrammatic drawing of the box.

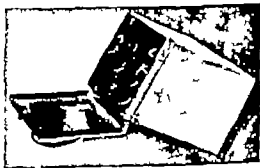


Fig. 2. Photograph of the box.

The dissecting forceps does not seize another instrument firmly, for it is not made for that. *Instruments should be used exclusively for the purposes for which they are intended.*

Well do surgeons know the inconvenience described and its dangers, but in the majority of our hospital wards nothing has been done to minimize the difficulties either because no one has paid due attention to the facts mentioned or because dressings are left to assistants or again because a proper case is not available for such purposes exclusively.

When I took charge of the Surgical Ward of the Ponce Hospital, I tried to find a case in which to carry ordinary dressings and which would prevent the drawbacks mentioned. I decided that an ideal dressing-box should carry out two basic requirements: (1) asepsis in picking up instrument, and (2) freedom in choosing it.

The first requirement means that when any instrument is being taken out those near it should not be touched. For this reason I have adopted the vertical position for the instruments placing them astride a partition as may be seen in Figure 1. The forceps and scissors are astride the lancets, sounds and curettes are in separate divisions. All are placed with the prehensile end exposed: scissors, their loops; forceps, their handles; lancets and curettes likewise and the sounds, their plunger or fin.

The second requirement is also met, for the surgeon can select at will the instrument most suitable to his needs, and on grasping it, he does not touch any other. For it is quite separate in its compartment. The instruments remain in order for each one has its proper place.

These basic requirements being filled we studied others no less important so that the box might be utilized in any surgical emergency without further outlay. We selected a box of universal pattern (Fig. 2) which is not only useful but can be easily sterilized. It fits into any sterilizing oven, and at the same time, carries any instrument of usual size so that the surgeon can put into it his outfit for private use. It is not necessary to purchase special instruments to fit the box. Thus it is practical, useful, and universal. The cost is equal to that of an ordinary barrel for dressings.

The dimensions are 10 by 13 by 18 centimeters, allowing space for the material for twenty dressings; that is to say it serves a ward with 40 patients and holds 40 forceps, 2 lancets, 4 pair of scissors, 2 curettes, sounds, and stilettes at will all in perfect order and all separated.

When the case is open the handles are exposed to view the points being turned inside which keeps them free from contact until the moment the wound is to be dressed.

The instruments that have been used are left on a tray to be cleaned. The case is cleaned by removing the partitions which come apart for the purpose.

The model which I present has shown excellent results backed by my own experience and the opinion of all those doctors who have used it in my surgical ward for two years. I can recommend it to my distinguished colleagues as a universal case for dressings which saves time, simplifies external medicinal applications, keeps the instruments in perfect shape, rigidly aseptic, absolutely clean, and in attractive form.

## A NEW METHOD FOR RHINOPLASTY

BY DR. OSCAR IVANISSEVICH BERNAS ALIER, ARGENTINA

From the Institute of Clinical Surgery

**B**ECAUSE of the difficulties with which the surgeon has to battle to obtain an acceptable result in a nasal plastic operation, I have proposed a new method of grafting at a distance. The method consists fundamentally of the following stages:

1. An oblique incision is made on the upper third of the helix of the external ear (Fig. 1). The lower border of the incision is immediately sutured with interrupted sutures.

A fresh surface is created on the fleshy part of the thumb so that it will attach itself to the upper border of the ear. This attachment must be very neat and be made in such a manner that the ear will remain doubled in its upper portion with the exterior plane facing inward and the interior plane facing outward, as in Figures 2 and 4. A last stitch with catgut fixes the cartilage to the bottom of the finger wound and a double skin stitch insures coaptation of bloody surfaces.

Once the surfaces in contact have healed and perfect union between the ear and the thumb is assured, a haemostatic forceps is placed in such a manner as to interrupt the auricular circulation. Gradually a new circulation is established through the thumb circulation and the ear flap is thus nourished.

2. When the circulation has been established sufficiently to maintain the life of the graft—and this can be determined by leaving the haemostatic forceps in place for 3 or 4 hours to

see whether the ear remains free from cyanosis or edema—one may proceed to remove the transplant from the ear (Fig. 5). Generally the circulation becomes established in from 16 to 18 days. When the transplant is removed, the lower border of the auricular wound is freshened and the edges of the upper and lower wounds united with separate non-perforating sutures which are tied on the inner face of the ear (Fig. 6).

The border of the transplant farthest from the ear is freshened and attached to the nose at the site of the defect, with the hand placed in such a



Fig. 3 (left) Rhombic incision of finger ball of left thumb.

Fig. 4 Suture of finger to ear. 4-5 Point of application of the haemostatic forceps.

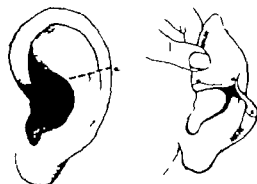


Fig. 5 (left) Auricular incision. 5-6 The ear is doubled in its upper portion.

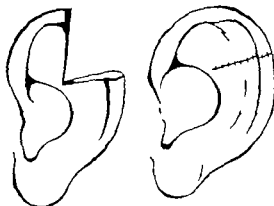


Fig. 5 (left) Auricular loss of tissue which is removed as a transplant needed.

Fig. 6 Restoration of loss of substance.



Fig. 7 (left) The auricular flap grafted in thumb and prepared for transplantation

Fig. 8 The auricular transplant sutured to the nose

position that the graft may be stitched in two layers the deeper layer with fine catgut and the superficial layer with skin sutures. This makes a very firm closure (Fig. 8). After 7 days, intimate union is established between the auricular transplant and the nasal border. A hemostatic forceps is applied at the top of the pedicled graft, and we test the circulation as we did in the first stage.

3. When repeated attempts to construct the circulation with the forceps show that the circulation is established (14 to 16 days are generally sufficient) the wound on the thumb is sutured by interrupted stitches. When the thumb is freed from the nose, the transplant generally becomes cyanotic and slightly edematous. There fore, it is left free at its posterior portion (Fig. 9) until the circulation is established.



Fig. 9 (left) Free portion and fixed portion of transplant

Fig. 10 Definite scars of transplant

4. When the edema and cyanosis have disappeared, the corresponding nasal border and the free border of the auricular flap are freshened and are stitched, in the same technique as used in attaching the transplant to the nose (Fig. 10).

Generally it is not necessary to use finishing touches, but when it is necessary, they are reduced to surgical acts of secondary importance.

As the graft itself is made up of a cartilage support and two skin surfaces, it has many advantages and its use makes the plastic operation for repair of the nasal soft parts an ideal one. On practical grounds the method has given wonderful results, leaving the nose, ear and thumb normal in every respect.

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Proced. med. Argentina, Buenos Aires July 30, 1939

## PARAVERTEBRAL ANÆSTHESIA IN KIDNEY SURGERY

By GUSTAV KOLISCHER, M.D. ALFRED E. JONES, M.D. OSCAR C. SCHNETZER, M.D. CHICAGO

THE development of modern renal and ureteral surgery with the widening scope of its indications has of necessity led to the employment of paravertebral anesthesia in this special work. Accumulating evidence has proved the fact that while the refinement of technique employed has reduced the surgical risk, the safety of renal operations is still impaired by unavoidable dangers if inhalation anesthesia is used. These dangers are particularly great if one kidney has to be removed and the burden of elimination falls upon the remaining one, or if the patient at the time of operation suffers from disorders of other organs the deficiencies of which are likely to be aggravated by general anesthesia.

Since Sellheim used paravertebral injection anesthesia successfully in abdominal operations, the same method has been repeatedly employed in kidney operations, and the problem remaining has been to develop a technique especially adapted to this purpose and answering the demands of safety and unshaken reliability in the production of operative anesthesia.

The abundance of material in the urological clinic in Budapest enabled Schnetzer to solve this problem on the living after extensive work on the cadaver had established all anatomical and topographical details. The blocking of the pertinent nerves was tested on about 600 cases at the Budapest clinic and except for a few instances to be reported, proved entirely satisfactory. Since that time this method has been employed by several surgeons in America and by ourselves and we have obtained results similar to Schnetzer's. There were four failures. In these cases after the operation was started the patients insisted upon general anesthesia for psychological reasons and not on account of physical pain. They declared that they could not bear the rattling of the instruments and the idea of being operated upon while conscious.

In infants the employment of paravertebral anesthesia meets with insurmountable obstacles on account of the difficulty of managing the youngsters. In transperitoneal kidney surgery a satisfactory anesthesia cannot be obtained by this method.

## TECHNIQUE

Just as in sacral anesthesia the most successful mixture proved to be a 2 per cent procaine solution with the addition of sodium bicarbonate,

potassium sulphate, and hydrochloric acid as follows:

	Formula	
Procaine		5 gram
Sodium bicarbonate		7 gram
Potassium sulphate		4 gram
Dilute hydrochloric acid solution		1 gram
Distilled water q. s. ad		30 ccs.

This solution is always freshly prepared before use and is sterilized by boiling for a few minutes. It is injected after having cooled off to room temperature. Sapparenin is preferable to adrenalin on account of being a synthetic product, which is more easily standardized than is the organic derivative. The only after-effect of sapparenin may be a slight rise in the pulse rate and blood pressure, both phenomena subsiding after a few hours. It is never necessary to use more than 150 cubic centimeters of this solution, and in lean individuals even 100 cubic centimeters may suffice.

For the actual injection it is of advantage to have the patient in the sitting posture with the legs dangling down over the edge of the table and with the back slightly arched. However, if deemed preferable the patient may be on his side opposite to the one which is the locus of the operation. In this case the head is slightly inclined toward the chest and knee and hip joints are flexed.

The skin over the whole half of the thorax is sterilized in the routine manner, this disinfection including the adjacent part of the abdomen.

In choosing the points of inserting the needle it must be kept in mind that it is necessary to block the eighth, ninth, tenth, eleventh, and twelfth thoracic nerves near their emanation from the intervertebral foramina distal to the junction of the anterior and posterior branches.

From cadaver work and clinical observation we have developed the following technique:

The scapula, the lower edge of the ribs, and the dorsal spinous processes are used for landmarks.

The first point of injection lies in an imaginary line drawn from the scapular angle to the eighth processus spinosus, at a distance of about 5 centimeters from the vertebral body. At this point an intradermal wheel is raised by using a fine needle for injecting the solution. In this same way four more marking wheels are raised following a vertical line drawn downward over the lower intercostal spaces. This secures superficial anesthesia facilitating the following deep injections. For this

purpose a long No. 18 gauged needle is attached to the syringe and the needle point is plunged in until it touches the lower edge of the rib. At this point 4 cubic centimeters of the solution is injected into the intercostal space. Then the needle is slanted and the tip pushed toward the median line until it touches the vertebra. Here a slight movement toward the front alongside the vertebra for about 0.5 centimeter will bring the tip opposite to the intervertebral foramen, where again 4 cubic centimeters are injected.

The same procedure is repeated in all the intercostal spaces. Before the paravertebral injection is attempted the syringe is detached from the needle each time in order to determine whether or not the tip has entered a blood vessel. If a blood vessel has been penetrated blood drips out of the distal end of the needle. A direct injection into a blood vessel might give rise to toxic symptoms. If such an accident should occur the needle must be withdrawn and reinserted under the same control. The tip of the needle may accidentally puncture the pleura. The patient coughs as soon as the needle point enters the pleura but if the needle is slightly withdrawn that closes the incident. In very muscular or in fat individuals it will be of advantage to increase the amount of the solution injected at the lowest point.

It is also a good plan after the paravertebral infiltration is finished to test the sensibility of the skin covering the field of operation. This is best done by picking up successively folds of the skin along the line of the intended incision and punching the folds. In case no complete anesthesia of the integument is encountered, this condition is brought about by intradermal infiltration with the same solution. It takes altogether about 20 minutes for the paravertebral nerve block to take full effect, and this time should elapse before the operation is started. The anesthetizing effect of this procedure lasts for about 2 hours, which time should be amply sufficient for the completion of any renal surgery.

The complete success of this method depends partially on the mental and physical preparation of the patient and upon the conduct of personnel in the operating room. The patient should be informed about the advantage of regional anesthesia, and it must be impressed on him that any fear of pain during the operation is unwarranted.

During the preparation of the patient and while he is placed in the proper position, quiet should be observed except for soothing remarks addressed to the patient, if necessary. The same holds good in the operating room, which should be darkened,

the operator and his assistants working under a spotlight. All clattering with instrument and splashing with solutions should be avoided. It is of great advantage to keep the patient's eyes covered with a moist compress and to have a special attendant sit at his head. This and an occasional inquiry by the operator will help keep the patient in a complacent mental attitude.

The use of narcotic drugs previous to paravertebral infiltration deserves some discussion. Generally speaking, the administration of such medication should be avoided if possible. Occasionally morphine depresses the kidney action and may nauseate the patient, and if as in rare instances will be the case it should be advisable to administer an opiate after operation, a cumulative effect may be produced.

On the other hand, if one has to deal with a very nervous and excitable individual a previous administration of a sedative may be necessary to bring about the complacency of mind in the patient which is essential for the success of the paravertebral anesthesia. In case pre-operative administration of a sedative is decided upon, the best way to give it is to place in the rectum about 5 minutes before the injections are started a suppository containing one fourth of a grain of morphine. This mode of medication promotes a slow absorption of the drug and prolonged action.

The employment of scopolamine however seems not to be advisable in kidney surgery. The efficiency of the kidney, an eliminating organ depends upon the quantity of blood forced through it in a given time. The retarding influence of scopolamine upon the circulation necessarily impairs the functional activity of the renal tissue, which fact may be of serious disadvantage especially if one kidney has to be removed and the remaining kidney has to take care of all the blood purifying work.

There are also advantages of the paravertebral anesthesia to be observed in the immediate post-operative stage. As a rule there is no pain in the operative region, the Wundschmerz of the German authors is missing because in the majority of cases the topographically involved nerves remain anesthetized for several hours and the occasional sensation of slight pain are easily controlled by sedatives.

Patient who are just recovering from a general anesthesia quite frequently become almost unmanageable during the state of semiconsciousness. They vomit, throw themselves around and once in a while it becomes necessary to restrain them forcibly. These exertions may not only lead to exhaustion but may also produce postoperative

hemorrhage. In the postoperative stage after paravertebral anesthesia, these unwelcome incidents do not occur on the contrary the patients quite often are more quiet after the operation than before. They not only do not suffer but appreciate that at a slight discomfort they bought freedom from all the misery following the use of general anesthesia.

To the paravertebral anesthesia may also be ascribed a very beneficial influence on the morale of all the patients in a surgical ward. If a patient after what is known to be a major operation is returned to his ward conscious and free from all the disagreeable aftermaths of a general anesthesia if as happens so frequently he, immediately after having been placed in bed, expresses a desire for food, or for a smoke, this complex cannot help but favorably impress his fellow patients.

#### SUMMARY

Paravertebral nerve block conducted by a proper technique furnishes in practically every instance a satisfactory anesthesia.

There is no mortality produced by a paravertebral anesthesia. It is applicable in all renal and

ureteral surgery executed through the retro-peritoneal route.

The method described above has been almost universally satisfactorily employed by the authors and other American surgeons in about 700 cases, with four failures only and these, without any prejudice, may be ascribed to the extreme neurotic condition of the patients.

Of the cases mentioned 16 were children between the age of 7 and 15 years.

Paravertebral anesthesia is particularly indicated in renal surgery when the patient to be operated upon is suffering from pulmonary circulatory or bilateral renal disorders. It is contra-indicated in infants and when it is necessary to perform the operation through the transperitoneal route.

The disagreeable and dangerous after-effects of general anesthesia as shock, nausea, vomiting, aspiration pneumonia, anemia acidosis, etc and those of spinal anesthesia, as malaise temporary paralysis or even *crisis letalis* are done away with in paravertebral anesthesia.

The technique is simple and easily acquired and mastered.

## EDITORIALS

### SURGERY GYNECOLOGY AND OBSTETRICS

FRANKLIN H. MARTIN, M.D.  
ALLEN B. KANAVEL, M.D.

Managing Edit  
Associat Edit

WILLIAM J. MAYO, M.D. Chief of Editorial Staff

JUNE, 1924

### NEW ZEALAND AND AUSTRALIA

LAND of adventure and romance. What boy of any age reading the voyages of Captain Cook, has not promised himself the pleasure of a trip to New Zealand and Australia those far flung provinces of Great Britain in the Antipodes? Six days out by boat from Vancouver San Francisco or Los Angeles, lie the Sandwich Islands. One should give himself a few days to visit this group the volcano of Kalauea, and in beautiful Honolulu should see the Queen's Hospital. From Honolulu to Suva Fiji Islands, is a sea journey of seven days. Suva is well worth a visit it is fortunate in its Government Hospital under Dr. Montague, chief of the Government Health Service and Dr. Harper. Full blooded Fijians here receive a two-year course in medicine and are taught to care for their own people. Three days on shipboard south from the Fijis brings one to Auckland the northern port of North Island, New Zealand. In three weeks one may visit briefly the two great islands, which are the size of Great Britain, with one and one third million fine people. To the west of New Zealand, three and one half days by boat is

Australia about the size of the United States without Alaska with about six million people. From Australia or New Zealand the return trip to the United States may be made by way of Tahiti and the Cook Islands to San Francisco or by way of the Panama Canal.

The medical profession of Australia and New Zealand is of a high grade and compares favorably with that of any country of the world. Medical men are highly esteemed by the people and politically are very influential. Quackery while not unknown is not in evidence. At Auckland we had the pleasure of attending a most instructive and interesting meeting of the New Zealand branch of the British Medical Association, Carrick Robertson the president, presiding with nearly four hundred in attendance. Many excellent scientific papers were read. A number of the medical profession of Australia including the well known surgeons, Worrall and Craig of Sydney and Russell and Ewing of Melbourne were in attendance.

At Napier we inspected the excellent General Hospital with Dr. Leahy and a fine hospital conducted by Dr. Moore. Wellington a city of about 100,000 people the southern port of North Island is the capital. With Dr. Herbert, Dr. Young and Dr. Elliott, the talented editor of the *New Zealand Medical Journal* we visited hospitals. We were greatly impressed with the work of Colonel Hunter of the Department of Health, who gives to classes of thirty girls planning to work in the outlying districts, a two-year course in the care of children's teeth which includes prophylaxis, extractions reconstruction and permanent filling.



From Wellington we crossed Cook's Straits and traveled down the east coast of South Island to Christchurch, an English settlement of about 80,000 on the Canterbury Plains. Here also, very good work is done in medicine and surgery. Dr. Fox is chief of the splendid general hospital where Dr. Foster, a most accomplished surgeon, gave several clinics. We were sorry not to see Dr. Adair, who was in England. From Christchurch we went by train to Dunedin, a Scotch town of 50,000 inhabitants, on the southeastern coast of South Island. In Dunedin is the splendid medical school of New Zealand of which Sir Lindo Ferguson is the Dean, and Professor Barnett surgical chief, where we saw much interesting surgical work. Several fine pieces of research work were shown to us, notably that by Professor Hercus on the relation of the absence of iodine in the soil, especially on the Canterbury Plains, to the incidence of goiter. Another research was on the various tests for echinococcus disease, which is extremely common in this sheep-raising country. At the School of Anatomy we were shown by Professor Gowland some dissections of the tuatara, an animal found only in New Zealand which throw interesting side lights on the development of the forebrain.

Sydney, our first stopping place in Australia, with its 1,000,000 inhabitants and splendid harbor is the London of Australia. Here we attended many excellent surgical clinics. We were unfortunate in not seeing Sir Alexander McCormick, who was in England, but we were fortunate in seeing Dr. Clubbe, whose work on intussusceptions and pyloric obstruction in infants has done so much to encourage early operation. One is impressed after meeting Dr. Todd, secretary of the Australian branch of the British Medical Association, with the high caliber of men who take on themselves the direction of these

societies. Prof. John Hunter, who holds the Chair of Anatomy of the University of Sydney Medical School, a young man only twenty-six years of age, has made a most important contribution to the study of the sympathetic nervous system in relation to muscular tone, which supplements the investigations of Gaskell and Langley. Professor Royle of the Orthopedic Department, acting on this new knowledge, has divided the rami communicantes which connect the spinal cord with the sympathetic ganglion and has had some extraordinary results in the relief of spastic paraplegia, Little's disease and certain Parkinsonian syndromes.

Melbourne, about six hundred miles south of Sydney is a beautiful city of 800,000 inhabitants. We had the pleasure of attending many fine clinics and were greatly impressed with the surgical work. Devine has made notable contributions to surgery of the stomach. Professor Syme, senior lecturer in clinical surgery of Melbourne University and Dr. Hooper, president of the Melbourne Medical Society, contributed much to the interest of our visit. Among the many interesting exhibits was that of Professor McArthur, who demonstrated some fine results, including a pregnancy following transplantation of a human homograph. Professors McKenzie, Berry and Osborne are adding greatly to our knowledge of comparative anatomy, especially of the nervous system and the gastro-intestinal tract by dissections of some of the most ancient animal life now extant. It is interesting to note that the small Australian bear which lives on the leaves of the eucalyptus tree has only rudimentary adrenal glands. This fact may have a bearing on adrenal deficiency disease.

The American visitor to New Zealand and Australia receives the most cordial welcome from these kindly people, who represent the

purest strains of the Anglo-Saxon race. Immigration is confined exclusively to the white race.

W. J. MAYO

## UNITED FRACTURES AND THE MASSIVE BONE GRAFT

**I**F clinical and roentgen ray examination of an ununited fracture discloses the fact that there is still attempt at repair union may be said to be delayed, even if many months have elapsed since the injury. If on the other hand examination reveals no attempt whatsoever to form callus though it may be but a few months since the injury the fracture may be said to be in a state of non-union. Until this differentiation is generally recognized there will continue to be a diversity of opinions with regard to the treatment of ununited fractures. Certain surgeons maintain that freshening the ends of the bone, drilling holes, applying metal or beef bone plates and so forth will induce union in ununited fractures, while others insist that bone grafting is the method to use. The fact is that the former have in mind delayed union, the latter their experiences with non union.

If a group of patients with ununited fractures that is from delayed union and non union were treated by any operative procedure except bone grafting a fair percentage would obtain union but if the results were investigated further most of the failures would be found in the non union group whereas most of the successes would be found in the delayed union group. Union may be induced comparatively easily in the cases of delayed union but in those of non union a fixed condition is being dealt with and union must be created rather than induced.

Therefore when the status of the fractures is that of non union bone grafting is the method of choice. If the fragments in the

roentgenogram show a marked degree of teoporosis due to lack of use and protraction the operation should be deferred until this has been overcome by active motion and use of the part.

The graft should be autogenous and large and abundant contact of the graft to the fragments should be obtained. The massive graft fulfills these requirements. The type of graft is applied as one would apply a metal or beef bone plate care being taken first to pare down the cortex of the fragments so that a broad contact is obtained of the deep vascular layer of the cortex in both fragments to the deep vascular layer of the cortex in the graft the medullary fat having been removed from the latter. After the ends of the fragments are properly freshened and shaped they should be brought firmly together and then the massive bone graft applied and held firmly by using heterogenous or autogenous screws. It thus acts as a strong internal splint as well as an autogenous graft. In the process of absorption and replacement which takes place in every bone graft a week pain is reached and at that time if the bone graft is small the laying down of the new bone is not sufficient in quantity to stand any marked strain. The larger the graft the greater the amount of this new deposit and a fracture of the graft is not of much consequence the callus taking on the planting duty of the graft.

If the distinction between delayed union and non union is borne in mind and the massive graft with its more or less exacting technique used particularly for the latter condition a higher percentage of good results will be obtained in the treatment of ununited fractures.

M. C. HENNINGSON

# MASTER SURGEONS OF AMERICA

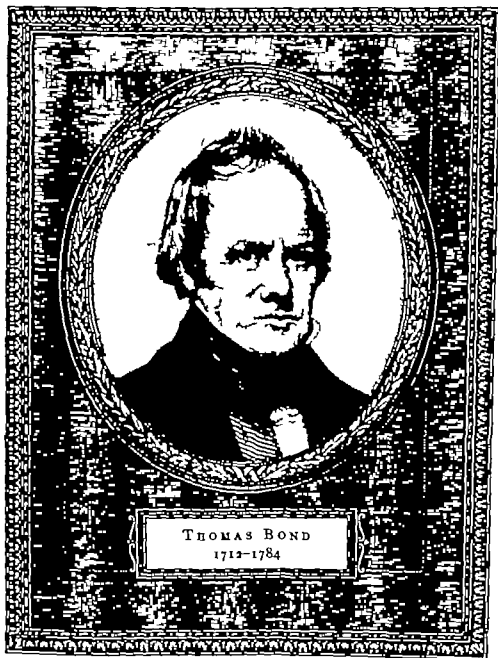
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THOMAS BOND

THOMAS BOND son of Richard Bond and Elizabeth Benson Chew Bond was born in Calvert County Maryland in 1712. We have little account of his early years, except that he studied medicine under Dr. Hamilton of his native county and then went to Europe, studying chiefly in Paris. Upon his return to America, he settled in Philadelphia and began practice in 1734. He soon took high rank as a surgeon as well as a physician. He was particularly distinguished for his skill in lithotomy. He was apparently the first in America to perform this operation, there being a record of such a procedure in 1756, four years previous to the operation by Doctor Jones, of New York, who is credited with this honor. Doctor Bond's dexterity is attested by a quotation from a letter written in 1772 by a layman, which says: "I had the curiosity to be present at the hospital at Doctor Bond's cutting for stone, and was agreeably disappointed for instead of seeing an operation, said to be perplexed with difficulty and uncertainty and attended with violence and cruelty, it was performed with such ease, regularity and success, that it scarcely gave a shock to the most sympathizing bystander, the whole operation being completed, and a stone 3 inches in length and 1 in diameter extracted in less than 2 minutes." "If," adds the writer, "surgery is productive of such blessed effects, may we not with Cicero justly rank it among the first of arts, and esteem it worthy of the highest culture and encouragement?"

The credit of originating the Pennsylvania Hospital is sometimes given to Benjamin Franklin, but he himself asserts that the suggestion came from Doctor Bond, and we find in the history of that period several such statements as this:

The foundation of hospitals among us produced the most important effects on the character of the medical profession, and forms a great era in our progress. The Pennsylvania Hospital, the first of these institutions established in the country, was erected principally by contributors of the benevolent citizens of Philadelphia, though aided by a grant of two thousand pounds from the Colonial Assembly and received its charter in 1751. Its establishment, as has been already stated, was owing to the suggestion of a physician, Dr. Thomas Bond. Up to the period of its foundation, no college of medicine existed on the continent, and the hospital, under the care of some of the first medical men of the period, early attracted the attention of both physicians and students, and very materially con-





tributed to the advancement and distinguished position attained by the medical school which was soon afterwards begun

When the Medical School was originated it was decided to ask Doctor Bond to give a course of clinical lectures the first regular lectures of the kind ever given in America. It is asserted that he had a regular class of thirty students in 1766 the first year. He began these lectures with these remarks

"I am now to inform you gentlemen that the Managers and Physicians of the Pennsylvania Hospital on seeing the great number of you attending the School of Physic in this city are of the opinion this excellent institution likewise affords a favorable opportunity of further improvement to you in the practical part of your profession and being desirous it should answer all the good purposes intended by the generous contributors to it have allotted me the task of giving a course of clinical and meteorological observations in it which I cheerfully undertake (though the season of my life points out relaxation and retirement rather than encumbrances) in hopes that remarks on the many curious cases that must daily occur amongst an hundred and thirty sick persons collected together at one time may be very instructive to you. I therefore purpose to meet you at stated times here, and give you the best information in my power of the nature and treatment of chronical diseases, and of the proper management of ulcers, wounds, and fractures. I shall show you all the operations of surgery and endeavor from the experience of thirty years to introduce you to a familiar acquaintance with the acute diseases of your country in order to which I shall put up a complete meteorological apparatus, and endeavor to inform you of all the known properties of the atmosphere which surround us, and the effects its frequent variations produce on animal bodies and confirm the doctrine by an exact register of the weather and of the prevailing diseases both here and in the neighboring provinces to which I shall add all the interesting observations which may occur to private practice, and sincerely wish it may be in my power to do them to your satisfaction

It is stated in several places that by virtue of the fact that he delivered the first clinical lecture in the United States at the Pennsylvania Hospital on December 3 1766 Dr Bond may be called the Father of Clinical Medicine in the United States, if not in America

When a petition to the Assembly to establish the Pennsylvania Hospital was read it was pointed out that the salaries to doctors would consume all the appropriation whereupon three members of the medical profession, Doctors Lloyd Zachary Thomas Bond and Phineas Bond his brother offered their services gratis for three years.

Dr Bond was elected a member of the First Board of Contributors of the Hospital but resigned at the end of a year to devote his time entirely to the Medical Staff. Dr Bond was one of the founders of the College and Academy

which afterward became the University of Pennsylvania. He was elected a trustee in 1749 and remained such to the time of his death.

He was also one of the original members of the American Philosophical Society and was elected vice president a position which he occupied as long as he lived Benjamin Franklin being the president during this entire period.

Accounts are given of several articles published in medical journals, some of them being the relation of interesting cases which he encountered in his practice. There is also an account of a paper read before the Philosophical Society on "The Rank of Man in the Scale of Being and the Conveniences and Advantages He Derives From the Arts and Sciences."

*The Standard History of the Medical Profession of Philadelphia* (page 434) states: "The earliest invention by a Philadelphian of which we have been able to find any record was the Bond splint invented by Thomas Bond for the treatment of fractures of the lower end of the radius and still much used for the purpose. He also invented an oesophageal forceps for the extraction of foreign bodies from the oesophagus."

Clinton Street Philadelphia was at one time named Bond Street as the result of a resolution passed at a meeting of The Contributors of the Pennsylvania Hospital. On motion it was unanimously resolved that the twenty feet street intended to be laid out as stated in the preceding resolution shall be named Bond Street in grateful recollection of the early long and faithful services of Doctors Thomas and Phineas Bond as physicians to this institution.

At the outbreak of the Revolutionary War Dr. Bond then past his sixtieth year tendered his services to his country in a letter dated December 4, 1776 this letter being addressed to the Committee of Safety. This received a favorable response and both Dr. Bond and his son rendered distinguished services to the American cause by taking an active part in the organization of the medical department of the Army.

Dr. Bond was a delicate man having, according to accounts, a tendency to pulmonary tuberculosis, but by unremitting care of his health he lived to reach the age of 72.

On a tombstone in Christ Church burying-ground, we find this inscription:

In memory of Thom<sup>s</sup>. Bond, M.D. who practised Physic and Surgery with signal reputation and success nearly half a century lamented and beloved by many respected and esteemed by all and adorned by literary honors sustained by him 11th day of March 1784. He departed this life March 26, 1784. Aged 72 years.

It is a pleasant coincidence to find as an introduction to Morton's *History of the Pennsylvania Hospital* a poem of a little later date by another distinguished Marylander Francis Scott Key.

## ON VISITING THE PENNSYLVANIA HOSPITAL

Whose fair abode is this    Whose happy lot  
     Has drawn them    these peaceful shades to rest  
 And hear the distant hum of busy life  
     The city noise    its clouds of smoke and dust  
 Vainly invade these leafy walls that wait  
     On high around it    sheltering all within,  
 And wooing the scared bird to stay its flight  
     And add to notes of joy to bless the scene!  
 The city toil and cares and strife are sure  
     Alike excluded here    Content here smiles  
 And eases and leads her    of ryes through the maze  
     Of flower embroidered    walks to bowers of bliss  
 O thus might I warm the heart of him  
     Who feels for man    "I hate the joys he sees!"

WALTER D. WISE



# TRANSACTIONS OF SOCIETIES

## CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD DECEMBER 21 1923 DR. CHARLES S. BACON PRESIDING

### A CASE OF FIBROMYOMA OF THE OVARY ASSOCIATED WITH UTERINE FIBROIDS

DR. CAREY CULBERTSON The specimen here presented consists of a uterus and its appendages. The uterus is small, trophic, and contains several small fibroid growths. Its cavity measures  $1\frac{3}{4}$  inches in depth and the mucosa is atrophic. One small fibroid growth was removed from the right round ligament. The left appendage is normal. The right tube is 8 inches in length, is closed, and is stretched about the circumference of the right ovary, which is represented by a fibroid mass 30 centimeters in its greatest diameter. The center of this growth is cystic and the microscopic sections show it to be a fibroma.

This specimen was removed from a negro 40 years of age who came into the hospital complaining of a swelling in the left lower abdomen and a sensation of weight and dragging in the left side. These symptoms were of months duration, with occasional vomiting. There had been no loss of weight or strength. The menses were established at 14 years of age, were regular in periodicity of 3 days duration and free from pain. The patient had never been pregnant.

Upon examination the abdomen was protuberant, rounded, obese, with firm elastic wall distended by a large, hard, irregular mass rising from the pelvis and ballotable. The mass lay more to the right side, was movable, and rose as high as the crest of the ilium laterally but four handbreadths above the symphysis. The percussion note over the mass was flat, with tympany about it. There was evidently free fluid also in the abdomen. Vaginal examination revealed that no part of the larger growth lay in the pelvis, this cavity containing only the uterus and left appendages, the uterus being slightly enlarged, irregular, nodular and free from the mass above.

Operation for removal of these tumors was uncomplicated, except for partial adhesion of the omentum over the fundus of the ovarian tumor. The abdomen contains about liters of free clear fluid.

#### DISCUSSION

DR. ARTHUR H. CURTIS I would like to know why Dr. Culbertson calls this fibroid rather than a desmoid. He also speaks of small desmoids.

DR. N. S. HEANEY What was the previous operation? In reporting the case of fibrosis of the ovary Dr. Culbertson mentioned that the tumor was ballotable and there was ascites. Sixty per cent of ovarian fibroids have ascites. I wonder if he has run across any explanation why such tumors are associated with ascites in such a large percentage of cases.

DR. CAREY CULBERTSON (closing the discussion) Desmoid tumor as I understand it, has come to be applied to the fibrous connective tissue growths developing in the intima of the abdominal wall. Sections show that this tumor is made up of fibrous connective tissue. The muscle bundles of the recti were in intimate connection with the tumor and had to be cut away from it.

In answer to Dr. Heaney, the patient stated that the previous operation was for a fibroid tumor of the uterus. The uterus was still present, so there had not been hysterectomy.

In answer to the second question, the cause for the ascites is unknown. The explanation usually given is that, being a tumor in the abdomen where there is peritoneal friction or irritation, excessive secretion is apt to occur. We find free fluid sometimes with fibroids of the uterus and often in pelvic inflammation. In this particular case there were two liters of fluid, more than is usually seen in the presence of benign growth.

### A CASE OF LARGE FIBROID TUMOR (DESMOID) OF THE ABDOMINAL WALL

DR. CAREY CULBERTSON This specimen consists of a large fibroid mass somewhat irregular in shape but approximately by 16 centimeters in diameter composed of multiple nodules. There is also one small separate fibroid growth.

The growths were removed from a negro 26 years of age who complained of discomfort in the lower abdominal wall and its protuberance. The swelling began as hard mass the size of hen egg 6 months previously and had rapidly increased in size. The patient had had 1 child and 4 years ago laparotomy had been performed for some pelvic condition. Since this operation the menstrual periods continued regularly of 3 days duration, scanty and free from pain.

Upon examination the abdominal wall was rounded and distended prominently by a hard, nodular mass fixed in the substance of the wall and grooved medially by the scar of a former section. Vaginal examination showed the small upright uterus to be apparently free from the abdominal wall and the growth in it.

Upon operation the mass proved to be a multinodular fibroid free beneath the skin and separating the recti muscles widely with the aponeurotic sheath above it. It appeared to have originated in the lower area of the old wound but was not continuous with the scar in the skin. The mass projected deeply into the abdominal cavity where it took on a peritoneal coat. The omentum was densely adherent over the upper portion of the growth with many large blood vessels passing cross to the lower portion the ileum was adherent in a rosette of three loops. A second small dermoid, the size of a walnut, lay in the fascia on the right side between the fibers of the rectus and external oblique muscles.

The appendix was not present. The uterus was small and buried in adhesions beneath the bladder. The tubes and left ovary were absent.

#### DISCUSSION

Dr J B DE LEE: I recall two cases of partial rupture of the rectus muscle following laparotomy. The hemostasis at operation was ideal but the violent vomiting afterward produced a break in the muscles with the formation of a hematoma and all the signs of peritonitis. This is important from the viewpoint of the differential diagnosis of post-operative peritonitis.

Dr ROBERT B KENNEDY: I saw a hematoma of the rectus muscle in a patient, 30 years of age, who had suffered from influenza 6 weeks previously. There was a tumor mass, 6 centimeters in diameter below the umbilicus and to the right of the midline. At operation the mass was found to be an abscess of the abdominal wall below the fascia. Culture showed streptococci. The patient gave a history of continued coughing during the influenza attack and the coughing may have produced a tear in the muscle with rupture of a vessel. A hematoma formed which later became infected and the resulting abscess formed.

#### ADENOMYOMA OF THE RECTOVAGINAL SEPTUM

Dr MARK T GOLDSTEIN and Dr SAMUEL J FOCKLESON contributed a joint paper entitled, "Adenomyoma of the Rectovaginal Septum" (See page 733).

#### DISCUSSION

Dr ARTHUR H CURTIS: This is a very interesting subject and the paper has been very ably presented. Dr Sampson I believe has not concluded that all these tumors have an intermediate growth in the ovary. He believes that the glandular tissue has origin either in the uterus or the fallopian

tubes sometimes the ovary is an intermediate host but sometimes the growth becomes implanted immediately. I somewhat doubt whether Dr Goldstone has proved the point that these tumors arise as a result of inflammatory conditions. It would be interesting for us to hear a little more from him in substantiation of this point.

Dr CARRY CULBERTSON: Dr Curtis has brought up a most interesting phase of this subject in his last remark, that is, whether these growths are inflammatory in origin or neoplastic. The German school represented by Meyer and Armann follow the inflammatory theory. Stevens reported a series of six cases in 1915 maintaining that these were true neoplasms, and Cullen later took the same position. Now there is very much the same situation in connection with similar growths developing in the tube where we again have the development of the disease which is rather generally accepted as inflammatory. Such growth is also found in tube that shows inflammatory reaction throughout. It is noted in simple salpingitis as well as in the pyosalpinx. We too have adenomyoma in the tube in the absence of inflammation. Here it is accepted as neoplastic. Ectopic adenomyoma, while developing in the rectovaginal septum is also found in other portions of the pelvis, as Cullen has shown, even in the intestine, so that it is difficult to see how as a result of inflammatory pressure, this growth would appear at such distance from the uterine cavity as it does. I am personally very much inclined to follow the teaching of Cullen and Stevens that, in the majority of cases at least it is neoplastic. It is easy enough to see why it was recognized in the early days as inflammatory because there are always adhesions in the pelvis, especially in the posterior cul-de-sac. Adhesions may be due to a pre-existing peritonitis or to the development of adenomyoma in the posterior cul-de-sac, because the spilling of blood or material through the rupture of a perforating chocolate cyst of the ovary would naturally set up plastic exudate. One of Dr Goldstone's slides showed definite round cell infiltration which is indicative of inflammation. Another interesting thing about this was hinted at in Dr Goldstone's remarks, that is the relationship between adenomyoma and malignancy. It is a remarkable fact that of all the adenomyomata that have been reported none of them has been shown to be malignant. There was not single malignancy in Stevens' series, there was none in Cullen's, none in McCarty. That is in line with adenomyoma generally. I have seen several cases of adenomyoma of the ovary all of them benign, and several of the uterine wall, all of them benign. Another interesting point is that developing in the rectovaginal septum they involve the rectal wall but never involve the rectal mucosa. Several of Stevens' cases and Cullen's cases demonstrated this fact. Therefore there is no rectal hemorrhage, as a symptom to cloud the issue and suggest rectal carcinoma.

Dr MARK T GOLDSTEIN (closing the discussion)

Regarding the etiology of the lesion I feel that Robert Meyer's theory is the best, because it is logical and he has something to work on. Lockyer's explanation of epithelial heterotopy or invasion is that the misplaced condition is there because the epithelium has invaded the muscle-muscular tissue is not essential to the process. Any epithelial infiltration following an inflammatory injury will penetrate the soft tissue and often in its process of repair the epithelial tissue runs out and branches out and you have a branching glandular growth. If this branching out of the epithelium takes place in muscular tissue the result is an adenomyoma. If for instance the invasion of the epithelium was solely into fibrous tissue you would have a fibroadenoma but the underlying factor is one and the same in both cases, that is you have an epithelial repair which goes on to excess until it becomes a pathological growth. In our cases we found definite evidence of inflammation. I once saw a stained preparation for plasma and mast cells because there were no other signs of inflammation.

#### GRANULOMA INGUINALE

DR. SEYMOUR S. SCHOCHEK contributed a paper entitled "Granuloma Inguinale" (See page 759).

#### DISCUSSION

DR. MARY T. GOLDWINE: I would like to ask Dr. Schochet whether these Donovan bodies are hard to demonstrate. If they are hard to demonstrate that probably accounts for the lack of reported cases. If we find these bodies in an ulcer and it does not respond to treatment would you consider them Donovan bodies or consider it therapeutic failure? If I understood the doctor right he said they could be confused with syphilis. Would you consider Donovan bodies in a case of syphilis with a typical ulcer if the case did not respond to treatment with tartar emetic. I believe it can be associated with syphilis and may resist the ordinary treatment, that is, the specific treatment.

DR. WILLIAM McLEWAIN THOMPSON: I have seen one case which answers this description. About a year ago a man came to me with a small papule in the right groin and with the inguinal glands considerably enlarged. This was opened and curetted, as it seemed simply an ordinary infection. The man had a history of syphilis though the Wassermann was negative at that time. He said he had been under treatment for several years. He then went south to a physician who had taken care of him when he had syphilis. The physician as kind enough to forward reports to me and I followed the case and saw him on his return to Chicago. Donovan bodies were found. The man returned to Chicago last summer in July. He was not under my care but I saw him in consultation. He had an enormous granuloma of the right groin extending from the anterior space to the scrotum. At my suggestion the treatment which had been given him in the south

was continued. This was the tartar emetic but I do not think it was given very carefully. After each injection he complained of severe reaction and the treatment was finally discontinued. I suggested radium but that was not given. An attempt was made to remove the granulation area entirely. It then involved the inguinal region on the right side, the scrotum, and extended almost down to the rectum. This was against my advice because I thought the prognosis was so bad that no amount of surgery could do any good. At the operation a portion of the scrotum was removed, the right testicle and as far as possible the entire growth. The patient was severely shocked but recovered. I again suggested the use of tartar emetic but the other physicians differed and he continued under such local antiseptic treatments as were used in ordinary infections. Radium was then applied but the only result was a large slough which continued to progress. I am sorry that I was not in a position to study the case myself. I saw it only a few times in consultation. The man died yesterday and presented the extreme picture that has been shown here in this paper this evening, of granuloma inguinale.

DR. CAREY CALVERTON: I have seen two cases of this disease, one in my own ward and one in the general ward at the County Hospital. Both of these were in the female. I agree with Dr. Schochet that it is without any question much more common than the report of the cases would show in this country. I believe that there are one or two cases every year in the general ward in the County Hospital. The case which was in my ward was treated by intra-arterial injections of a solution of tartar emetic and I thought for a while that there was some improvement but finally decided there was not. The case did not remain under observation for a long enough period of time to continue the treatment effectively. As the Doctor said, it is extremely resistant to any form of treatment but the important thing from a clinical point of view is that this condition must be recognized as an entity and not confused with syphilis or regarded as a broken down elephantiasis, as tuberculosis, or as some of the ulcerations with ordines such as we see following ordinary infections. It is, however, not a surgical lesion and surgical excision would in all probability be followed by extensive sloughing and the production of a worse condition than that presented by the initial lesion.

DR. J. P. GREENWELL: I would like to bear out what Dr. Schochet said regarding the incidence of this disease. During 1909 and 1910 I saw six cases in the Gynecological Out Patient Department of the Johns Hopkins Hospital. Sections were made for diagnosis, but no tubercle bacilli or spirochetes were found in any of the sections. All the patients were referred to the department of syphilis and externally treated, some with temporary improvement but none permanently cured. Dr. Calverton is right when he says the lesion is not one for operation for the one patient who was operated upon

(by Dr Cullen) had a recurrence. Five of the six patients are colored and all had had the disease for long time.

Dr ARTHUR H. CURTIS. We had a somewhat similar experience at Camp Pike, Arkansas. This Camp was more or less of a filter for venereal diseases and at one time there were 5,000 people with venereal infection. During my time there we encountered 10 or 12 patients with this disease.

Dr ROBERT B. KEENE. A case occurred in Harper Hospital, Detroit, in 1921. This was a white adult male. The case was treated with antimony and cleared up.

Dr A. F. LASH. In regard to the case Dr Culbertson mentioned, I was interne on the service and gave the treatment. I gave cubic centimeters of 1 per cent solution and increased the amount to 14 cubic centimeters without producing any bad results in the patient but without producing any good results. After about months treatment the patient became discouraged and left the hospital.

Dr S. J. FORDMAN. While I was at the County Hospital during 19 and 1923 in the men's surgical and genit. urinary wards we had two similar cases which were treated with solutions of tartar emetic but which failed to respond. On the suggestion of Dr Edward Oliver we applied locally iodoform dissolved in ether and promptly cleared up both cases.

Dr STONEY S. SCHUCHET (closing the discussion). There were so many questions asked that I will try to answer some of them. In reply to Dr Goldstone, I would call this case granuloma inguinale unless Donovan bodies were found. The second point is whether we can have syphilis and granuloma inguinale in the same patient. There are cases reported with positive Wassermann and there are cases which must be classified as syphilis instead of granuloma inguinale. I think those cases that give a positive Wassermann in which there is a doubtful finding of Donovan bodies should be classified as syphilis rather than granuloma inguinale. The third question, whether these two conditions can be found together, I do not know. I presume a patient could have two different infections, just as one may have a broken arm and a broken leg. I have seen cases of yaws and syphilis in the same individual. They are cured by the same drug but they are different diseases. One dose of salvarsan will cure yaws but it will not cure syphilis. I think the sooner we get away from treatment as means of diagnosis the better our medical literature will be.

The question asked by Dr Thompson, I believe, referred to the limiting of treatment to drugs. We have specific in tartar emetic. We also have a very good synthetic preparation the trisodium of antimony which was prepared by Dr Abel some years ago. I think if we would persist in the intravenous treat-

ment the results would be better with medicine than with surgery. Whether surgery is justified I am not in position to say.

As Dr Culbertson says granuloma inguinale is more common than diagnosed and I think we ought to study these cases more thoroughly. I am glad to hear that the cases are being recognized. It is important to diagnose these cases because once a source of infection is established it is difficult to eradicate it.

Dr Curtis mentioned the fact that it is very prevalent in the south. I can vouch for that. We have all types of tropical disease in the south. This disease is very prevalent in the south but unfortunately is not always recognized.

Regarding the failure of treatment referred to by Dr Lash it is possible that the solution was not properly prepared. I would like to ask the doctor if the solution was boiled.

Dr LASH. Yes.

Dr SCHUCHET. That accounts for it. If you give more than one tenth of a gram of tartar emetic which is boiled the patient as a rule complains of severe pains in the arms and in the chest. I do not like to make this remark but I think you were giving decomposed tartar emetic. When you realize the chemistry of tartar emetic you will not boil it just as you would not boil salvarsan. Whether iodoform or other are good drugs to use I do not know. Ether is a good solvent for fats. I think some brilliant results have been obtained with ether in the peritoneal cavity. This has been thoroughly reviewed by Dr Tarnowsky. I think we should limit our treatment to tartar emetic or some of the synthetic preparations.

Dr CURTIS. What about sterilization by heat?

Dr SCHUCHET. Any heat will break up the tartar emetic solution and produce a toxic substance.

At the request of the president D. Carey Culbertson read a sketch of the life of Dr D. Wylie, the noted gynecologist who died recently. Dr N. S. Heaney asked why this matter was presented to the society. Dr Bacon replied that it seemed proper in some way to acknowledge the death of prominent members of the gynecological profession.

The president announced that since the last meeting the official stenographer of the society, Mr. William Whitford, had passed away. Dr Carey Culbertson moved that the secretary be instructed to place a notice of Mr. Whitford's death on the minutes of the meeting and to forward a letter of condolence and sympathy to the family. The motion was seconded and carried.

Dr Rudolph Holmes announced that Dr Horatio R. Storer, an honorary member of this society died about a year ago and the Secretary was instructed to write a letter to his son who is now living in Boston.





LXXVI



LXXVII

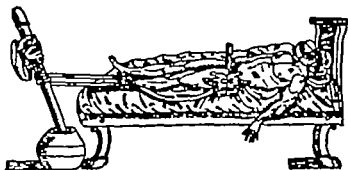


CXXV



CXXVI

- A. Ligamentum scapulae ad humerum.
- B. Ligamentum humeri ad cubitum.
- C. Ligamentum cubiti ad manus.



Non quatuor



## REVIEWS OF NEW BOOKS IN SURGERY

In the introduction of his book on *Surgery of the Spine and Extremities* Taylor states: "No attempt has been made to make the work encyclopedic, but an endeavor has been made to put into the hands of the reader a brief and useful text book. On the whole the object has been accomplished. The first part of the book is given over to 'Orthopedic Technique.' This is probably the most valuable part of the book as the descriptions are accurate and the illustrations illustrative. It also deals with the use of apparatus in detail, and it is just these details that make the difference between efficient and non-efficient treatment. The second part deals with spinal affections and covers the subject completely, but in some points briefly. In the third part, on 'Affections of the Extremities,' all the most modern ideas are discussed."

The book is thoroughly up to date. The illustrations are numerous and for the most part well chosen. Many of the cuts are not of the best so that the detail is poor. This is particularly true of the X-ray pictures.

B. H. MOORE.

A collection of essays on orthopedic surgery is presented taken from the writer's papers published between 1877 and 1898. There is, of course, nothing new in them and all orthopedists are already familiar with their contents for they are classics by one of the pioneers in orthopedics. One is therefore tempted to ask: Why are they published? There is enjoyable reading in them. They are models of accurate thought, and there is much sound common sense in them. They are of historic interest too. But it is the greatest pleasure in reading them that has been because of the beautiful literary style in which they are written. It is serious, simple, direct and therefore impressive. We are strongly reminded of Osler in this, and wish that literary style might have more of place in modern medical literature.

B. H. MOORE.

**BECK'S Applied Pathology: Diseases of the Throat, Nose and Ear** is unique contribution to American otolaryngological literature. The author's aim, as he states in the preface, has been

to present to the student and practitioner a textbook for the study of the diseases of the throat, nose and ear, based on the latest researches and the experience of the author.

Selected Essays on Otolaryngology. By Newton McLean. New York and London: G. P. Putnam's Sons, 1901.

Applied Pathology of Diseases of the Throat, Nose and Ear. By Joseph C. Beck, M.D. F.A.C.S. New York: Mackay Company, 1901.

to apply pathological entities to otology symptoms, diagnosis, and prognosis and thereby arrive at a rational basis for treatment. The work is limited almost exclusively to the personal experiences of the author. It discusses not only the diseases of the nose, throat, and ear but also the acute diseases of the trachea, bronchus, and esophagus, and the chronic affections of these parts. Most of the subjects treated in this volume are discussed fully, some with hardly sufficient detail. We wish at times that the author had given his reasons for the particular views he holds. The language is not always clear and the Latin terminology not always correct. On the whole Dr. Beck has here produced an interesting and valuable work. It is printed on good paper and the illustrations are numerous and excellent.

G. A. TOWNSEND.

THE radium report of the Memorial Hospital of New York contains in this edition a discussion of thirteen groups of malignancies in which it is believed that the technique and results will not soon materially change. Eleven members of the staff submit the report featuring the present status and scope of radium and X-ray therapy as viewed by Dr. William S. Stetson and the late Dr. H. H. Janeway. The Munster lecture from the transactions of the College of Physicians of Philadelphia, by Dr. James Ewing concludes the volume and presents a discussion of radiation therapy from the standpoint of extensive pathological study. Presentation is made of relative standing of various methods of general treatment of malignant groups giving technique, case reports, immediate and extensive follow-up results. Summaries and conclusions are given by the clinicians reporting each series. A résumé of the cancer problem in relation to radiation is ably presented by competent clinicians and pathologists. There is much repetition probably because of the fact that previous published material has been included with reports especially prepared for this volume. The report presents the results of careful work with an abundance of material extending over several years, and indicates a broad viewpoint and an earnest effort on the part of the authors to further what they believe to be a definite step forward in the treatment of malignant growths. Every medical man dealing with malignancies would profit by a thorough knowledge of this publication.

Radium Report of the Memorial Hospital, New York, 1901. New York: Paul Hoeber, Inc., 1914.





them being Fijis and three East Indians. The Fijis with their heads of bushy black hair were in their native costume—a one-piece garment of white—with bare feet and legs. They are six footers and look the real savage bearing out our school-day impressions. The three Indians were much smaller and looked quite ordinary beside their picturesque companion. Through the first-aid course for native nurses and the hort course for native physicians the government has provided with wisdom for the care of this large population of Islanders.

#### NEW ZEALAND—THE TWIN ISLANDS

In a brief sketch it is impossible to follow one a log and to detail the many interesting experiences and sights that were viewed. In making a bird's-eye survey of our visit to the southern continent of New Zealand and Australia I shall have to content myself with a brief summary and depend upon the future and another more suitable medium in which I may give a more amplified account.

I will touch particularly upon the medical societies, the hospitals, the medical schools and the people and very briefly on sight seeing and entertainments.

#### MEDICAL SOCIETIES

The annual meeting of the New Zealand branch of the British Medical Association, which we attended gave us an opportunity to compare their national conferences with our own. There was an extensive program of papers in the three principal sections—medicine, surgery, and the head specialties.

The papers were not unlike those presented at the sections of the American Medical Association. They were practical and well written, and the readers presented them as their individual tastes dictated. Some of them read the entire paper, others made a formal presentation from notes. A peculiar feature of the discussions was the fact that a time limit seemed not to be enforced. However, those who entered into the discussions had made careful preparation, and they usually spoke from notes. The discussions were comprehensive and extremely interesting. There was a noticeable absence of the senseless habit of inflicting complimentary remarks upon the essayists, which so frequently prevails with us.

The opening general meeting, which was given civic and national recognition, was very formal, inasmuch as His Worship the Mayor of Auckland, J. H. Gunson Esq. C.M.G. C.B.E. and His Excellency, the Governor General, Viscount Jellicoe, lent their presence and delivered speeches of

greeting. The Minister of Health of the Federal Government, The Hon. Sir Maui Pomare, made a short address. The foreign guests, including the Australians, the United States representatives and the British (the latter represented in the person of Sir J. Lynn Thomas, K.B.E. of Cardiff, Wales) were given recognition. Special attention was accorded to the members of the medical profession from the United States by asking Dr. Mayo to respond to the greeting that was extended to our party, which besides our own group included Dr. Francis Patten Emerson of Boston, and Dr. Thomas Hubbard of Toledo. The retiring president, F. G. Gibson, M.A., M.D., M.R.C.S. of Christchurch, gave his address, and the incoming president, Carrick Robertson, M.D., B.S., F.R.C.S. of Auckland, read an interesting paper on the Importance of Diagnosis in Surgical Diseases.

The opening function was held in the Town Hall, and there was an impressive gathering of the members of the British Medical Association, their wives and a number of distinguished lay citizens. An interesting feature of the formalities was a procession of the platform guests and the wives of the speakers and the civil officials who took part in the opening addresses. Following the formal program, supper was served in the adjoining hall and an informal reception was held.

In the principal cities we visited—Auckland, Wellington, Christchurch, Dunedin, and Napier in New Zealand, and Sydney and Melbourne in Australia—there are local branches of the British Medical Association which have an affiliation with the mother society corresponding to our county medical societies. Similar societies are established in the other communities of importance in these two countries.

In New Zealand and Australia much interest was manifested in our American College of Surgeons and its program of hospital standardization. One morning of the Auckland conference of the British Medical Association was given over to the discussion of hospital betterment. I was asked to outline the program that the American College of Surgeons is carrying out in the United States and Canada. The subject was discussed by Dr. Mayo, Dr. Harte, several New Zealand and Australian surgeons, and Mr. William Wallace, the lay president of the Auckland Hospital.

At Melbourne the medical society held a special meeting for the purpose of discussing hospital standardization, and to this meeting the local hospital representatives were invited. I was asked to present the subject in detail, whereupon Dr. Mayo, Dr. Harte, and Dr. Smith of our group

elaborated the program. A very lively discussion ensued and through the many questions which were asked by local members of the profession we succeeded in making clear the comprehensive program which we are pursuing in Canada and the United States.

A similar meeting was held in the lecture room of the medical school at the university in Sydney. The same order of procedure was carried out, and the discussion which followed was even more acute than that at Melbourne. The hospital problem in these countries is one that is receiving much attention.

The medical societies tendered to us several formal and informal banquets. Their larger functions were much more formal than our own. The program is arranged with much care and certain individuals are selected to make formal toasts in introducing their speaking guests. Some of these introductions are elaborate and always carefully prepared and while they are occasionally rather overpowering in their flattery, they are usually most interesting. At the large banquet given by the New Zealand branch of the British Medical Association at Auckland, the speech by Dr. J. S. Elliott, of Wellington, touring the United States representatives, was of the highest type of oratory, and most flattering to our group. It would be hard with absorbing interest by any United States citizen.

#### THE WORK OF DR. ROYLE AND HUNTER

Dr. W. J. Mayo and I spent one afternoon in the experimental laboratory of Dr. John Hunter, the young Professor of Anatomy University of Sydney and Dr. N. D. Royle, Honorary Orthopedic Surgeon to the Lewisham Hospital and the State Children's Relief Board. Their work has attracted much attention here, dealing as it does with the influence of the sympathetic nerves in spastic paralysis. I felt immediately that our afternoon spent with these two young workers would have interested every surgeon of the world. They first showed us their macroscopical specimens, and then led us to their experimental laboratory where they demonstrated their de-cerebrating operation on a goat, and the effect upon the muscles of the lower extremities as the result of severing the sympathetic nerve control by dividing the rami communicantes, which connects the spinal cord with the sympathetic ganglion. Later they took us to their lecture room and showed us several reels of films which demonstrated their experimental work and the result of Royle's surgery in spastic paralysis cases.

Dr. Royle then took us to the Clinic and presented a dozen patients with spastic paralysis whom he had asked to present themselves. Everything we saw here impressed us with the importance of the work of these two young men, and the conscientious care with which they are carrying it out. Dr. Hunter, the anatomist, is not more than twenty-seven years of age, and his manner of presenting his work showed him to be of unusual caliber. Dr. Royle, the surgeon, is about thirty-five years of age and has the respect and admiration of all of his contemporaries. These men will visit the United States in October as our guests at the Clinical Congress of the American College of Surgeons. Those interested in this epoch making work may read the latest articles in the *Medical Journal of Australia* for January 26, 1924, on pages 77 and 86, the first, "A New Operative Procedure in the Treatment of Spastic Paralysis and Its Experimental Basis" by Dr. N. D. Royle, and the other "The Postural Influence of the Sympathetic Innervation of Voluntary Muscles" by Dr. John Hunter.

The same afternoon we were the guests of the Students' Club of the University at a gathering in the Great Hall, where several hundred had come to welcome us. The chairman, a young man, stated the occasion of the gathering. Professor John Hunter, whose guest we had been earlier in the afternoon introduced us. Dr. Mayo and I each spoke briefly. We were received with great cordiality and the enthusiasm of our auditors as worth coming a long distance to witness.

#### HOSPITALS

In looking forward to my visit to New Zealand and Australia, I had anticipated with interest the pleasure I would derive from a comparison of their hospital system with that of Canada and the United States. The medical men of the world, especially those of our era, are almost unanimous in the belief that the most satisfactory system of hospitals is that which prevails in the United States and Canada—from the standpoint of serving the best interests of all patients, the well-to-do and the poor, and as well the best interests of the entire profession. It was our hope that the great island continent of the southwest Pacific, which has shown so much independence of action in the establishment and conduct of their governments, had exerted the same initiative in the organization of their hospitals by breaking away from the obsolete traditions of Europe. Alas, that is not true, but the medical profession of these countries, especially those who have observed hospitals else-

where, are fully aware that their hospital system is hampered by traditional drawbacks, and they are extremely anxious to work out a plan that will preserve all of the advantages of the old and obtain the advantages of the new. This must be done, too they realize, with evolutionary rather than with revolutionary methods and without incurring prohibitive expense.

I surveyed cursorily the hospitals in five of the larger cities of New Zealand viz Auckland, Wellington, Christchurch, Dunedin, and Napier, two cities in Australia, Sydney and Melbourne, one hospital in Suva, Fiji Islands, and one in Honolulu. Almost every general hospital in New Zealand and Australia is of the same type, viz supported either by the governments, the states, the municipalities, and in some instances by more than one of these governing authorities. Like the great hospitals of London, these institutions are exclusively for the pauper poor, and for those who are able to pay a small fee for hospital care. The acting staff is known as the honorary staff. The members serve without compensation nor are they allowed to receive fees from the pay patients of these hospitals. Each hospital is, as a rule, in charge of a full time medical superintendent who cares for all emergency cases and has general supervision over the care of the sick. If the hospital is of sufficient size, he has one or more salaried assistants—a pathologist, an x-ray operator, etc. Each hospital has its own training school for nurses with a competent matron and assistants in charge. The massive institutional architecture of most of the buildings dates back to the end of the last century. The later additions, as expansion demanded, are of a similar type of architecture, or very often of the conventional type of the period. As artificial heating is not a necessity and as land was not a problem when the sites were selected, the grounds are ample, and the structures are of the pavilion type, connected by passage-ways which have roof, but are usually otherwise partially or wholly unenclosed.

The general hospital of New Zealand and Australia, with the exception of the fundamental defects of organization referred to above, are of the standard type and in equipment compare favorably with those of Canada and the United States. They have attending staffs of the outstanding men of the profession who conscientiously devote their time and skill to the care of the patients of the institutions. They do this without compensation, and with considerable sacrifice of time. As in London, their private work of hospital nature must be done in a private hospital or

nursing home. The staff meetings, where developed at all, are rather in the nature of clinical society meetings than for the purpose of discussing the professional conduct of the hospital.

Each institution has a well-equipped laboratory with many of the latest refinements, some including up-to-date metabolic departments. These laboratories have full-time technicians, and in most instances a full-time paid pathologist is in charge. The x-ray departments are adequate, a few of them with apparatus for applying deep-ray therapy.

The records are well looked after and in nearly all of the institutions clerks are employed who aid in writing and filing the reports. It is a definite responsibility of the internes to keep these records complete. Separate record findings for the various departments are required by almost all of the hospitals.

As no professional fees are collected from the patients in these large general hospitals, they are devoid of the abomination of fee division.

With the prevalence of general hospitals of the type described above, there is a definite demand for private hospitals in which patients of means may be treated by the doctors of their choice and in which the patients are privileged to pay for professional services rendered to them. For that reason many small institutions abound which bear the name of the doctor who owns the hospital. Some of these private hospitals are reconstructed residences, with a matron (usually a trained nurse) in charge. Obviously these small institutions are dependent, to a greater or lesser degree upon less adequate organizations than the general hospitals, especially in regard to laboratories, x-ray service, operating-room equipment, and a regular nursing organization, all of which are abundantly supplied in the general hospitals.

This anomalous state of affairs compels the most competent physicians and surgeons in the two countries to utilize private hospitals, some with inadequate facilities and thereby places the conscientious man of the profession at a great disadvantage because he is unable without great effort and inconvenience to provide for his patients of means the same facilities that are accorded to the poor in the general hospitals. The people of means themselves are at an even greater disadvantage, as the private hospital is, consequently, a last resort for them instead of the haven of opportunity which is afforded by the hospitals of the United States and Canada.

As soon as the profession and the people of Australia and New Zealand learn of the inconsistencies and the difficulties which are the result

of this situation, they will do one of two things. Either they will allow their general hospitals to degenerate into purely pauper institutions by encouraging the building of more comprehensive private hospitals, or they will do what would be much more advantageous—combine with their large and expensive equipments of general hospitals, pavilions equipped to care for patients of means who may then pay not only for their hospital treatment, but also for the professional services which they receive from their physicians or specialists.

#### GENERAL HOSPITALS

##### NEW ZEALAND

The *Auckland Hospital*, one of the largest institutions in the two countries, contains 540 beds. Two hundred nurses are pursuing the course in the nurses training school. The full-term nursing course occupies four years, but the students have the privilege of taking a licensing examination at the end of three years. The complete laboratory is in charge of a full time pathologist. The records are comprehensive and are looked after by the heads of the several departments, the internes, the superintendent, and clerks. The medical superintendent has his home on the hospital grounds. This superintendent, Dr Charles Evans Maguire, is a trained hospital executive of more than local reputation, full of ideals and obviously thoroughly conscientious. The hospital has several pavilions, including a children's department, and a luxurious home for nurses located on the grounds. The site is in a beautiful part of Auckland, and commands a fine view of the city and of the picturesque harbor.

The *Wellington Hospital* which houses 300 patients, has a substantial building with several pavilions. It cares for the poor and other individuals of the country who present themselves. A small hospital fee is asked of those who can afford it. It is not permissible to pay a fee to any member of the attending staff. The honorary staff consists of four medical practitioners, four surgeons, one anesthetist, and one genito-urinary specialist. There is a separate state maternity hospital. The *Wellington Hospital* has a part time radiologist, and a part-time pathologist, each of whom have paid technicians. The house staff consists of a full-time medical man who does some clinical work but who cannot receive fees, and a superintendent, who has jurisdiction over an assistant superintendent and six house internes. The internes receive, besides their housing and board, £500 a year. The training school, which has a course of four years, is in charge of a matron who is a trained nurse. Automatically the graduates are

licensed to practice anywhere in New Zealand. The bacteriologist of the hospital is a full time official, and does work for practitioners of the country. He has six assistants. Records are well kept and take into consideration the work of all departments. There are get together meetings of the house staff, but staff meetings of the type required by our minimum standard are not developed.

The *Christchurch Hospital* with a 300-bed capacity has several fine permanent buildings. An honorary staff is organized and the doctors are not permitted to receive fees. Either no fee, or a very small fee, is asked for hospital service. The well-equipped laboratory is under the supervision of a full-time director. The X-ray department is up-to-date, the operating rooms are thoroughly equipped, and the records are kept by the internes. There are staff meetings, but not for the specific purpose of reviewing the professional conduct of the hospital. One hundred and twenty nurses are pursuing the three-year course of training. Dr Fox, the chief, was our host on the occasion of our visit to Christchurch Hospital.

The *Dunedin Hospital* is virtually a part of the medical department of the *Dunedin University*. Its buildings are attractive and consist of several units which have a capacity of 300 beds. Dr Falconer, the medical superintendent, is enthusiastic about his work, and was careful to explain in detail the conduct of his institution. There are eight house officers or internes who receive, besides maintenance, £100 the first year and £50 the second year. The training school has seventy pupil nurses. A three-year course is required for graduation, but those who desire advanced training may take a graduate course of one year. Each nurse receives £ for her outfit, and in addition £50 the first year, £40 the second year, £50 the third year and £60 the fourth year. The records are not too comprehensive, but include bed side notes, pathological findings, and the blood and urine records, which are worked up by the internes. The laboratory is in the medical school. The X-ray equipment is of the conventional type and is located in the hospital building. The operating rooms are well equipped and up-to-date.

The *Napier Hospital* is beautifully situated on a bluff overlooking the city and the sea, and has a capacity of 50 beds. It has a training school for sixty nurses, with a three-year course. This hospital is conducted on the plan of the other New Zealand institutions, with an honorary staff free and small pay patients, but no fees to physicians. The hospital site is capacious and several separate pavilions accommodate the different departments.

## GENERAL HOSPITALS

## AUSTRALIA

The *Melbourne Hospital* the largest in that municipality is centrally located and has a capacity of 400 beds. It is one of the few hospitals visited by us in the two countries with circumscribed grounds. It occupies one city block and is compactly built to cover the entire ground, with no room for expansion except in additional height. However it is thoroughly equipped and has a large and enthusiastic staff. One of the interesting features of our visit here was our presence at a clinical meeting of the attending honorary staff with the house staff. Several patients were brought in and presented, and an animated discussion ensued. There was a very interesting, spirited, and critical play of words, give and take, between the internists and the surgeons. The hospital is a university institution where the 120 senior medical students receive their clinical instruction. It cares for free patients and those who pay a small fee. No fees are paid to members of the attending staff (known as an honorary staff) who are clinical teachers in the medical school. The well-equipped laboratories are under full-time directors; the X-ray equipment is thoroughly up-to-date, and there is a complete system of records. A large training school for nurses is connected with the institution.

The *Alfred Hospital* of Melbourne, is one of the most complete and beautiful of all of the hospitals we visited. It covers a large plot of ground and is comprised of two and three story pavilions which are connected by long covered galleries. Its present capacity is 340 beds, but it is planned for 600 beds. The laboratories and X-ray departments are complete. This is a teaching hospital connected with the medical school, and conducts a training school for nurses with a capacity at present for ninety-two pupils. This institution is under the control of a board of managers, not unlike our own hospitals, and is partially supported by voluntary contributions, with a small grant from the government. Its staff meets once a month and conducts a clinical meeting. It has a fair system of records, and the patients are free and small pay with no fees to the attending staff.

*St Vincent's Hospital* Melbourne a Roman Catholic institution with a capacity of 120 beds, is conducted on the plan of the Alfred Hospital, viz under private control with a small governmental grant. Also it furnishes teaching facilities to the University medical department. The free beds are supported by private philanthropes and by a grant from the government according to the number of

state patients who are cared for. This institution is attractively located and evidently very well conducted. It has up-to-date laboratories, an ample X-ray department, and unusually attractive and well-equipped operating theaters. Its records, with a system of cross indices, are comprehensive, and the record department is in competent hands. The training school for nurses, with eighty pupils, has a three-year course the admission requirement being a grammar school education. There is an honorary staff and no fees are paid to physicians or surgeons by pay patients. This hospital is in close proximity to a private hospital the St. Evans which is conducted by the same order of nuns and offers a solution to the hospital problem in Australia. I shall speak of this in considering private hospitals.

The *Sydney Hospital* located on an elevated site with capacious grounds, is one of the institutions of the University of Sydney. It has a capacity of 350 beds and conducts a nurses training school which has 120 pupils. The comprehensive records are in charge of a registrar and an assistant registrar. The laboratories of this institution are unusually complete and have a full-time pathologist, bacteriologist, and radiologist. The Sydney Hospital, which commands the best professional talent in Sydney, cares for free patients, and receives a small fee for hospital care from patients who are able to pay. No fees are paid to the attending staff for professional services.

The *Royal Prince Alfred Hospital* of Sydney, one of the largest and most complete that we visited in Australia, is a teaching hospital affiliated with the University. This institution which obviously is well conducted made a favorable impression upon our group. It is attractively located and its architectural appearance is satisfactory. It cares for the free patients and patients of moderate means who can pay for a part of the expense of hospital care. There is no provision for patients of means. The training school with its four year service requirement has 200 pupil nurses. The pathological department is in charge of a competent pathologist, and apparently is well equipped. The records appear to be comprehensive, and are cared for by a full-time registrar.

The *Royal Alexandra Hospital for Children* in Sydney which was one of the most satisfactory special institutions that we had the privilege of visiting on our pilgrimage, is a most complete institution for the care of children. Privately conducted, with the genial founder Dr. Charles P. B. Clubbe, still acting as president, it is supported by philanthropic contributions with limited government grants for the care of free patients. The at

tractive building on the two-story pavilion plan is beautifully located on spacious grounds with room for expansion. It has a capacity of 340 beds, provides clinical teaching facilities for the University and has an honorary and exclusive staff as do all of the general hospitals in Australia. It has an up-to-date dental department, where nurses are instructed to do first-aid work on the teeth of children and a training school for nurses in which 120 pupils are taking the four-year course of training. The operating rooms, the pathological department, the record department, and the X-ray department all appeared to be thoroughly satisfactory. A full-time mechanic and a shoemaker are employed to make shoes, splints, and other orthopedic apparatus. None but children are treated in this hospital.

The *Lewisham Hospital* Sydney is one of the few general hospitals of the two countries which accommodate on the same grounds a free government-grant institution and a private pavilion where patients of means may be cared for and pay for the professional services which they receive. This institution is conducted by the Blue Nuns, a Roman Catholic order and provides 200 beds for the free general hospital department, and 100 beds for pay patients in the private pavilion. It has the usual records, conducts a large out-patient clinical department, and has recently installed an up-to-date X-ray apparatus. The *Lewisham Hospital* makes a very favorable impression and there is little to distinguish it from many of our best Catholic hospitals in the United States and Canada. In addition, it emphasizes the human aspect, which is always imparted by the woman's touch, and which so many hospitals lack. If the governments were to copy this institution in the conduct of their general hospitals, viz., add a department where patients of means could be treated as private patients, they would, in my opinion, establish an ideal system. This institution provides for free patients and those who can pay a small fee for hospital care, the professional services being given by the regular honorary staff and in an isolated portion of the same building with the same adequate equipment, the members of the honorary staff may care for their well-to-do patients and receive fees for the services they render. Here, too patients of means may be provided with hospital service and be cared for by their own physicians or specialists.

*St Vincent's Hospital* of Sydney is a general hospital (free and small pay patients) conducted by Roman Catholic sisters. This hospital, too has provision to care for a limited number of full-pay patients who may be treated on the plan which is

carried out by private hospitals. It has 200 beds, and there are 108 pupils in the training school which provides a four year course. It has its own laboratory X-ray and out-patient departments. While I did not have an opportunity to examine the records, I was informed that they were complete. The hospital receives governmental aid and its honorary staff gives clinical instruction to the students of the University medical school.

Hurried visits were made to two very creditable hospitals devoted to the treatment of women, the *Queen Victoria Hospital*, and the *Womans Hospital*, both of Sydney.

#### PRIVATE HOSPITALS

New Zealand and Australia are provided with innumerable private hospitals. These range from small institutions of the grade of the nursing home located in old, remodeled private homes, to large, well-constructed buildings especially built for hospital purposes. Several of the best of these are under the jurisdiction of the Roman Catholic church.

*Mercordia Hospital* Auckland, is a small institution of this type. It is beautifully located on a site overlooking the city and the harbor and is conducted by the Sisters of the Sacred Heart. It has at present a capacity of 35 beds, with a plan for immediate expansion. Its laboratory work is done at the nearby Auckland Hospital. Its future of usefulness is fully assured, as several of the leading professional men of the city are utilizing its facilities.

The *Lewisham Hospital* of Christchurch, is another institution conducted by nuns. It is a well-equipped private hospital of sixty-bed capacity. Recently it established a laboratory and installed an up-to-date X-ray department. Its records are fair it has no internes, and the administration is exclusively in the hands of the nuns. It is one of the institutions for private work which is popular with the leading men of Christchurch. Our impression of the worth of this hospital is most favorable.

The *St Eonan's Hospital* of Melbourne touches a high-water mark as a deluxe institution for the care of pay patients. Architecturally and from the standpoint of furnishings it is very adequate and most artistic. With a capacity of 120 beds, it furnishes accommodations for individuals of moderate means and luxurious apartments for people of wealth. Its laboratory and x-ray departments are conducted in conjunction with the general hospital, *St Vincent's* which is located in the adjoining block and which is conducted by the same order of Catholic nuns. I have referred pre-

viciously to this arrangement in connection with solving the problem of combining free and private hospitals. This advantage was illustrated for us here through the work of Dr. Devine, an eminent surgeon who does his teaching and charity work under auspices which enable him to render adequate service also to his private clientele. He has only to step from one pavilion to another which is in close proximity to perform his public service and his private practice under familiar environment and management.

The *Bea Side Hospital* of Sydney is an attractive private hospital with a capacity of 35 beds. It is in large grounds and it is constructed for comfort, with large outdoor porches upon which the beds of the adjoining rooms may be placed when desired.

The *Lexisam Hospital* of Sydney I have already referred to as combining the general hospital advantages with the facilities of a private hospital. It is conducted by the Blue Nuns of the Roman Catholic church. Its capacity is 200 free beds and 100 beds for people of means. Here, however, the advantage is marked inasmuch as the two organizations are in one enclosure and under identical supervision. Cleanliness and good management are apparent. The accommodations for the poor and the wealthy are equally acceptable. The patients of means are privileged to pay for exclusiveness and for the services of their own physicians for professional care.

The *Ua Memorial Hospital* at Suva, Fiji Islands, marks a successful effort to build an up-to-date hospital in the tropics on a small island at the edge of civilization. I have already told of this attractive institution which is located on the heights overlooking the picturesque harbor of the island commonwealth. It furnishes accommodations for 80 patients in the three-story building which has been completed but recently. Besides the hospital accommodations, it has a thoroughly up-to-date out-patient dispensary. There is a training school for native nurses (a one-year course) which fits them to do first and work among the natives of the Fiji Island, and also a training school for full-time nurses (a three-year course) to care for the Caucasian and other inhabitants of the islands. It is affiliated with the F. J. Medical School where native students are trained to practice medicine among their people. The hospital is under the immediate charge of an Englishman, Dr. P. T. Harper who acts as superintendent. Dr. A. A. Montague, of Suva, chief of the honorary staff and the training school is under the able supervision of Matron Pankhurst, an English nurse. The provision for laboratory and X-ray

departments, and the operating theaters are thoroughly adequate. It is an institution that will not suffer by a comparison with any hospital on the islands of the Pacific Ocean that we visited. It would be a credit to any community.

The *Queen's Hospital* of Honolulu, is a new, well-equipped institution for private and free patients. It is supported by fees from private patients, philanthropists, endowments from private sources and grants from the municipality of Honolulu. Dr. N. P. Larsen is the pathologist in charge and Mr. George C. Potter is the superintendent; also it has a Board of Trustees. Its wards and private rooms (some of the latter luxuriantly furnished and with private toilets and baths) afford a capacity at present of 214 beds. The thirty-five pupils in the nurses' training school are Coreans, Chinese, Hawaiians and Caucasians. The five internes are obtained from the best schools in the States. The hospital is equipped with every modern facility—an X-ray department with full-time technicians and complete laboratories with a full-time director. The staff is a closed one and meets once a week for consultation. The county pays \$2.50 a day for the care of each of its county and city patients and this is the only expense to the government for caring for its indigent, although it has all of the advantages of a general hospital. Patients of means are allowed to pay fees to their attending physicians and specialists.

#### MEDICAL TEACHING

We visited and inspected the medical teaching schools in three cities—Dunedin in New Zealand and Melbourne and Sydney in Australia. Dr. Mayo touches upon medical teaching and other subjects in an editorial in this issue of *SURGERY, GYNECOLOGY AND OBSTETRICS*, page 833.

#### ENTERTAINMENTS

Everywhere we received a warm welcome and every hospitality that we had time to accept was ours to enjoy, whether tendered by the governments, cities, medical societies, universities, hospitals, or individuals.

We were fortunate to be guests of honor at a dinner in the Government House at Auckland, given by Their Excellencies the Governor-General and Viscountess Jellicoe of New Zealand. No one could fail to appreciate being entertained by this brilliant figure of the late war, the hero of the Battle of Jutland. He was most cordial in his welcome to our party of United States citizens. His Worship the Mayor, J. H. Gunson, Esq., and Councillors of Auckland entertained the members



of the British Medical Association in the Town Hall, where we were the guests of honor and where Dr Mayo responded to the Mayor's speech of welcome directed to the United States representatives. The Mayor's car was at our disposal while we were sojourning in Auckland. In nearly every city we visited we were entertained by the various civic clubs, including the Rotary Club and the various English-speaking societies. One or more and sometimes all of the men of our delegation were expected to respond to the toast to the American visitors.

In addition to the civil governmental and professional entertainments, we attended a delightful tea given by Mr and Mrs Kenneth Mackenzie at their home, "Waiauroa," in the bush a harbor excursion and luncheon given by the Auckland Harbor Board and Auckland Hospital Board a charming musicale at the residence of Dr and Mrs W. H. Parkes and a beautiful out-of-door pageant a "Rose Garden Revel" given at Cintra under the supervision of Mrs Parkes. One of the most brilliant affairs of the conference week was the Presidential Ball given by Mr and Mrs Carrick Robertson at Scott's Hall.

One of the features of the British Medical Association conference in New Zealand was an elaborate banquet which reminded the United States visitors of the good old days before our country chose water in preference to wine. Here it was easy to become eloquent and to enjoy the plaudits of congenial good-fellowship.

In Napier we were the guests of Mr and Mrs T. H. Lowry at their home, seventeen miles out, where we saw a sheep station in one of the great sheep-raising regions of the world. In the dinner that we enjoyed here we obtained some idea of the charm of this life where people of culture live close to nature and do things worth while.

Through plans made by our friends we enjoyed about six hundred miles of motoring in New Zealand. On the northern island we motored from Rotorua through the thermal regions and over three ranges of mountains to the sea at Napier an experience that included unusual scenery and a thrilling ride of nearly two hundred miles.

On the southern island we motored to Lake Wanaka at Pembroke and to Mount Cook, in the premier mountain range of New Zealand. These trips were most enjoyable as they gave us an opportunity to see much of the sheep and cattle raising industries, to see the people as they live on the far distant stations in the interior country and finally it gave us time to contemplate and to rest from our arduous week of meetings and entertainments.

In Dunedin, in Christchurch, and in Wellington, our spare time was occupied with delightful private and semi-public dinners, luncheons, and teas. A ball at Sir J. J. and Lady Ferguson's and afternoon tea at the country place of Dr Frederick Ratcliffe Riley with a motor ride over the mountains skirting Dunedin, were delightful features of the hospitality extended to us. On the last evening of our stay we were entertained by the surgeons and their wives at a delightful dinner and dance given at the Savoy Hotel.

Our visit at Christchurch was of brief duration, but most delightful. It included a breakfast with Dr and Mrs Philip Stanley Foster and a beautiful drive over the hills for tea at the Kiwi Tea House, with a group of medical men and their wives. For dinner we were separated into small groups, Mrs Martin and I dining at the delightful home of Dr and Mrs J. Gibson.

During our one day at Wellington the hospitality was boundless. A large dinner was given by Dr James Sands Elliott, the editor of the *New Zealand Medical Journal*, and Dr William Edward Herbert, the leading surgeon of New Zealand. Later in the same evening we were the guests of the English speaking society.

Before closing my remarks on our entertainments in New Zealand I must not neglect to tell of the opportunity the government furnished us to see the native Maoris in the most advantageous way. A special train took the members of the British Medical Association from Auckland to Rotorua, one of the principal home centers of these interesting aborigines. These people, while many of them are now educated and cultured, retain many of their ancient customs, among others their traditional songs and dances. This was an unusual occasion as the Maoris were called from far and near to reproduce for us a series of entertainments and dances similar to those extended to the Prince of Wales on his recent visit. By an impressive ceremony which involved long speeches, the members of our group were enrolled in the different tribes and given various implements of warfare and peace. Dr Peter Buck, a leading physician and a Maori, was the host. Dr W. J. Mayo was made chief of a tribe, and given a robe of office and a staff of authority. The presentation was made by one of their beautiful maidens. This required that he crouch with her the ancient custom of rubbing noses, an impressive ceremony which caused envy on the part of less fortunate visitors.

#### AUSTRALIA

Upon our arrival in Australia we found that in addition to our sight-seeing and professional en-

agements, our time was to be well filled with interesting functions, social and professional. In Melbourne, on the day of our arrival, the Lord Mayor and the Lady Mayoress (Mr and Mrs W. Bounton) gave us a reception at the Town Hall. Several hundreds were invited. The affair was formal and ceremoniously associated with a tea. Toasts were drunk, and the Mayor formally welcomed each one of us in turn and we were called upon to respond.

On the afternoon of March twenty-seventh we were the guests of the English-speaking Union (Victoria Branch), held also at the Town Hall. It was a large and formal affair. Sir A. Robinson presided and made the opening address of welcome. Professor Osborne introduced Dr Mayo, who in replying expressed our appreciation of the courtesies extended to us. Dr Richard Harte of our party also made an interesting response. The Premier Mr Lawson, welcomed our new American Consul-General and his wife who were also guests of honor on this occasion.

On the same evening the Council of the British Medical Association (Victoria Branch) and the Surgical Association of Melbourne, entertained the men of our party at dinner and later in the same evening we joined the ladies at a reception given at 9 Downing Street. The Governor and Countess of Stradbroke, representing the Crown, entertained us at a formal dinner on Friday evening at the State Government House. Malverne. Saturday afternoon, under the immediate guidance of Dr Dunbar Hooper we were the guests of a group of surgeons and their wives in a forty-mile drive to Black Spur, a resort in the foot-hills, near which is a state reservation for the aborigine bushmen. Here we witnessed expert spear and boomerang throwing by the natives. Here too under the guidance of Dr McKenzie we saw many of the animals of Australia which are rapidly becoming extinct, and which show the embryonic type actually functioning. Saturday evening, reluctantly of course, we accepted under special arrangements myrtle seats at an important boxing match at which Fox, a light-weight champion of England, wrestled in an exciting twenty rounds one Ferco, a light-weight favorite of Australia. The same evening the ladies of our party attended the opening night of the opera, presenting Madame Melba, who took the leading rôle in *La Bohème*. Thus was retained a seeming balance of culture.

Sunday morning Dr H. B. Devine, one of the brilliant younger surgeons, took us on a bird's-eye exploration by automobile. We dined the same day with Dr G. A. Syme, another of the dis-

tinguished surgeons of Australia, and later in the afternoon we met several hundred members of the profession and their wives at his charming home. On Monday we were the luncheon guests of the Prime Minister of Australia, Mr Bruce and his cabinet, at the Federal Parliament House. On our final day we were the guests of the federal librarian in the morning and Dr and Mrs Mayo and Mrs Martin and I lunched with the Governor-General and Lady Forster at the Government House.

Sydney was not a whit behind Melbourne. In the entertainments provided for its guests Wednesday evening we were the dinner guests of Dr and Mrs Ralph Lyndal Worrall at the Queen's Club. Thursday we were lunched by the Premier of New South Wales and the members of his cabinet at the State Capitol.

As guests of the State we motored to the Blue Mountains and the famous Caves of Jenolan. The car provided for our use was a magnificent one, luxuriously accommodating fourteen people and their baggage. The trip required two days, and is one of the great sights that should not be ignored by ambitious travelers. The caves are approached by a picturesque mountain drive from the coast, through vineyards and sheep and cattle stations, to the foot-hills covered with summer homes, and finally into rugged mountains where be the famous Caves of Jenolan, which are most wonderful and extensive. We were accompanied as hosts by Dr Robert Hy Todd, the Secretary of the Australian branch of the British Medical Association. Dr F. P. Sanders, professor of surgery in the University and Dr J. W. Lipscomb.

I cannot refrain from making special mention of the personal attentions that were extended by Dr P. Finaschi, which added much pleasure and comfort to our visit in Sydney.

On Monday we attended the meeting of the Rotary Club. On the occasion of the much anticipated visit of the British Fleet, headed by the great battleship *The Hood*, we were guests of the Minister of State for the Commonwealth of Australia, on the S. S. *Barro B.* Later in the day we were transferred to small motor boats and became the guests of Drs C. V. and R. S. Bowker. We sailed about the beautiful harbor which was very animated on this fleet-day and lunched on their boats on a little bay in a picturesque spot near The Heads opposite the city. On Monday we lunched *en famille* with Dr and Mrs R. Gordon Craig at their home overlooking Centennial Park. Immediately afterward we visited the magnificent Zoo with Dr Todd, who more than anyone is responsible for its organization and existence. Besides containing a large col-

lection of interesting specimens, the Zoo occupies an outstanding and picturesque site on a rugged promontory overlooking the harbor opposite one portion of the city. Here we had tea and returned by launch early in the evening.

Thus everywhere on the three continents we were official guests of the federal, state and civil governments, and were given flattering receptions by the medical societies, the hospitals, the universities, the civic clubs, and most markedly by the medical profession as organizations and as individuals. The women of our party were enthusiastically entertained at luncheons, teas, dinners, motor rides, theaters, and the opera. The warmth of hospitality of these people can never be forgotten by the pilgrims from the United States of America.

#### THE PEOPLE OF AUSTRALIA AND NEW ZEALAND

If a Royal Commission had been selected two hundred years ago to discover somewhere on earth ideal lands, with an ideal climate with ideal topography, and with a diversity of resources, it could not have made a better selection than Australia and New Zealand to provide for a high civilization. These islands extend from the milder tropics through the temperate to the milder frigid zones of latitude. They have rich agricultural plains that will grow in abundance all sustaining foods; they have rolling hills on which to graze their cattle and their sheep; they have marvelous mountain ranges that furnish all varieties of minerals to the world, and that reproduce the scenery of Switzerland and the beauties of our own Rockies in Canada and the United States. They have thousands of miles of seashore rugged and beautiful, with capacious harbors for commerce and long stretches of pleasure beaches that

reproduce the charm of Brighton and Atlantic City. The islands are large enough in area to house an empire of people and to duplicate the wealth and culture of the United States or England and they are isolated enough to make it possible to cultivate an independence that will rid them of the undesirable and antiquated traditions and usages of the older countries.

The people of Australia and New Zealand are our kind of folk. They are predominantly Anglo-Saxon and they or their immediate forefathers had the vision and independence to select these far-off islands for a future home. They must have had in their make-up not only a spirit of independence, but as well of initiative, of ideals, of frugality and of industry. This combination in any people makes the character that will peacefully conquer the world. They are the survival of the fittest of a great civilization. These people create just that impression upon the stranger visiting their shores—the survival of the fittest. The settlers of these far-off countries, after assuming the responsibility of establishing their homes there, have exercised their good judgment and insisted upon keeping their stock pure by refusing to mongrelize themselves by unwise intermixture of races. The people of these countries, because of the equable climate, live in the open; they develop physically and mentally in the out-of-doors; they are advocates of friendly contest and sports which engender the spirit of fair play; they are predominantly meat eaters, raising the stock of their great grazing plains. Physically and mentally the men are veritable giants; the women are strong and self-reliant, and have a great charm and culture of person. These countries have a future of infinite possibilities, which will aid in balancing the peace and prosperity of civilization.

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